BULLETIN OF THE

Southern California Academy of Sciences

LOS ANGELES, CALIFORNIA

Nostra tuebimur ipsi.

Vol. XXXVI   January-April, 1937   Part 1

CONTENTS

Issued May 1[illegible], 19[illegible]

Southern California Academy of Sciences

Office of the Academy
Los Angeles Museum, Exposition Park, Los Angeles, Cal.

FLUORITE BEADS IN CALIFORNIA

By Arthur Woodward

The use of the softer grades of stone, particularly steatite, in the manufacture of ornaments, by the pre-historic Indians of southern California is well known. However, the use of fluorspar or fluorite, as a similar manufacturing medium may not be so widely known, hence the writer has deemed this information to be of sufficient interest to archeologists to warrant the publication of this brief item.

The first mention I have been able to find concerning the discovery of fluorite beads in prehistoric sites is that noted by S. S. Haldeman in his description of artifacts taken from the Chumash sites, La Patera and Dos Pueblos, near Santa Barbara in 1875.[1]

Unlike the aboriginal turquoise workings in the San Bernardino desert area, lately described by Malcom Rogers of the San Diego Museum,[2] and by Dr. Gustav Eisen of the California Academy of Sciences in March, 1898,[3] no accounts of the Indian use of the Mohave desert fluorspar deposits have yet been made. In fact, I am not at all certain that the natives ever used the latter mineral as extensively as they did the turquoise deposits of California, Arizona and New Mexico, and the steatite of Catalina Island and the more recently discovered ledges of fine grained soapstone of the Sierra Pelona. Incidentally the latter deposit contains a thin vein of the beautiful, pale green, jade-like steatite used by the Canalino in making some of their nicest ornaments. This outcrop is located in the Sierra Pelona Range, Ventura County, at an elevation of about 5,000 feet, and when investigated by Richard Van Valkenburgh for the Los Angeles Museum, during an archeological reconnaissance in 1933 the deposit, now being operated commercially by a Mr. McCain, was said to have indicated aboriginal working. An old Indian village site located at the base of the hill was found to contain many fragments of worked steatite vessels of the same type mineral as that of the ledge high on the mountain.

---

[1] U. S. Geographical Survey West of the One Hundredth Meridian, in chargre of Lieut. Geo. M. Wheeler, v. VII, Archaeology, p. 264, pl. XIII. Washington, D. C., 1879.

[2] Rogers, Malcolm J. Report of an Archaeological Reconnaissance in the Mohave Sink Region. The San Diego Museum, Archeology, v. I, no. 1, February, 1929.

[3] Article, Long Lost Mines of Precious Gems Are Found Again, etc., a report on the expedition made to the turquoise mines in the Mohave Desert by Dr. Gustav Eisen, in the San Francisco Call, March 18, 19 and 27, 1898.

In 1932 while visiting the old asistencia site of Santa Margarita, formerly an outpost of Mission San Luis Obispo, I found a large, oval-shaped, purplish stone bead with flattened ends which at first glance I assumed to be glass, never having seen a stone bead of such translucence and such color on a California site. However, once the earth was removed from the ends of the bead the native drilling was exposed, thus putting an entirely different aspect upon the find.

Various jewelers were questioned as to the nature of the mineral and at first inspection the verdict was usually "amethyst" or "amethyst quartz." Closer scrutiny and scratching of the surface with a steel point soon brought a swift denial that it was either amethyst or quartz. In 1935, Mr. E. F. Walker, working under the auspices of the Southwest Museum, uncovered a Yokuts cemetery in the Elk Hills region on the north shore of the now dry Buena Vista Lake in the lower end of the San Joaquin Valley.[4] In the course of his excavations Mr. Walker found a number of the same type purplish stone beads. Still later in the fall of 1936, Mr. W. B. Murbarger, a collector for the Charles W. Bowers Memorial Museum in Santa Ana, found more of the same beads in burials on the South Fork of the Santa Rosa River in San Luis Obispo County.

In April, 1936, Dr. Wayne E. Kartchner of the State College of San Jose, Calif., kindly identified the beads as being made of fluorspar.

The next problem was to locate the possible origin of this mineral which might have supplied the Indian craftsmen with the raw material for their ornaments.

Dr. Kartchner loaned me a copy of "Technical Publication No. 500, Fluorspar Deposits in Western United States," by Ernest F. Burchard, Washington, D. C., published by the American Institute of Mining and Metallurgical Engineers, Inc., 29 West 39th Street, New York City, 1933,[5] from which I have drawn liberally in the following statements.

At the present time the mineral fluorspar occurs in two major deposits in Arizona, one in California, seven in Colorado, seventeen in New Mexico, one in Nevada and one in Utah. There are other deposits further east but those are of little interest in the present discussion.

---

[4] Walker, Edwin F. A Yokuts Cemetery at Elk Hills. The Masterkey, the Southwest Museum, v. IX, no. 5, September, 1935.

[5] Burchard, Ernest F. Technical Publication No. 500, Fluorspar Deposits in the Western United States. New York, 1933.

Hubert W. Davis in his report on "Fluorspar and Cryolite" in Mineral Resources of the United States, 1920, Pt. II, Non-Metals, Washington, D. C., 1923, pp. 65-80, states that:[6]

"Fluorspar or fluorite, chemically calcium fluoride, (CaF_2) consists of calcium and fluorine in the proportions of 51.1 to 48.9. The mineral is often spoken of as 'spar' but the term is misleading as the same term is also applied to feldspar, barite (heavy spar), calcite (calc spar, Iceland spar) and several other minerals. Fluorite is only slightly harder than calcite (in another article published in 1925 Davis reports fluorite with a hardness of 4 and a specific gravity of 3.2), and consequently crushes easily but it may be distinguished from calcite by its failure to effervesce with dilute hydrochloric acid. It crystalizes in the isometric system and is often found in cubical crystals. In color fluorspar ranges, according to purity, from a clear colorless, or slightly bluish glasslike substance through various brilliant shades, of which purple and green are most common, and much of it is white and opaque. The mineral is usually very pure, some of the material marketed running 98 to 99 per cent of calcium fluoride. It commonly occurs in veins cutting both sedimentary and igneous rocks." (pp. 65-66.)

So much for the chemical properties of this substance.

"Prior to 1898 fluorspar was used chiefly in the preparation of hydrochloric acid and the manufacture of opalescent glass, but since 1899 when it became generally recognized that fluorspar possessed many advantages over limestone as a flux in the manufacture of open hearth steel, by far the greater part of the output has been used in the steel industry." (Id. p. 67.)

Regarding the deposits of the mineral in California, Burchard states (pp. 6-7):

"Fluorspar is reported to occur in seven or eight places in California, most of them widely scattered within the southern half of the state. Most of these occurrences are in connection with other mineral deposits and not of commercial value. Certain of these have been noted by D. F. Hewett in the New York and Clarke Mountains of San Bernardino County. Deposits in small veins are reported by the State Division of Mines as occurring south of Baxter, 4 miles east of Nipton and 25 miles south of Cima.

---

[6] Davis, Hubert W. Fluorspar and Cryolite, Mineral Resources of the United States, 1920. Pt. II, Non-Metals, U. S. G. S. Pub'n. Washington, D. C., 1923.

Afton District

"Efforts to show up a quantity of fluorspar have been made in the desert 2½ to 5 miles south south-east of Afton, San Bernardino County, and this district was visited by the writer in October, 1926. Several groups of claims have been located there in an area of low hills and ridges south of the Mojave River. The country is well dissected by canyons that can be traversed by auto-trucks, although with difficulty in places where the sand is deep and dry. The relief is less than 500 feet in the vicinity of the claims and the altitude is about 2,200 feet. In all, there are said to be about forty lode claims of approximately twenty acres each, within an area nearly three miles square.

"The fluorspar is associated with fine-grained, grayish where fresh, andesitic rocks, finely porphyritic in places. The andesitic rocks occur as intrusions and as flows over 'red beds,' a coarse sandstone, sometimes conglomeratic. In places a white, hard volcanic ash overlies the red beds and is in turn overlaid by andesite. There are also red granite and basalt in the region and limestone is reported.

"The volcanic rocks are closely fractured, forming breccias in places, and the brecciated material along certain zones contains much crystalline fluorite, which not only forms veins and cementing material in the crevices but has replaced the rock to some extent. The veins are from a few inches to 4 feet thick and the fluorite, bearing zones of brecciated rock are of irregular size and shape, ranging from 1 to 50 feet thick. Some of them have been traced for a distance of 3,000 feet. Erosion shows the depth of the deposits sometimes as much as 50 feet. In the richer parts of the fluorite-bearing zones there may be locally 10 to 40 per cent of fluorspar in the rock but such areas are not extensive. Much silica and calcite is present but metallic sulfides were not noticed. The silica occurs both as quartz and as white, opaque fluoritic material. A little prospecting has been done by means of cuts and short tunnels. There is little good crystalline spar of greenish and purplish colors, but hardly enough to warrant commercial production of lump spar.

"No fluorspar has been recorded officially as having been produced in California, but people interested in claims near Afton say that a carload of picked spar was shipped from there several years ago."

The same writer sums up his statements on the deposits of fluorite in California by saying: "The deposits described in California are only in one locality but others in southern and central California have come to attention as well as many more in Arizona." (Id. p. 23.)

Unfortunately the localities of these "other" deposits in California are not given. Hence we may only presume that the

beads found on the sites in San Luis Obispo County and those on the Elk Hills site have come from the deposits in San Bernardino County.

If this hypothesis is true, it opens up more interesting speculation on the trading proclivities of the desert tribesmen and their ultimate sphere of influence.

On the other hand, if one of the unknown deposits in California is located in the region of San Luis Obispo, the chance of the discovery of an aboriginal mine is equally interesting.

It may be that the Yokuts people were the middle men in the trading of the fluorite beads. Certainly the evidence of various stone artifacts found in burials at Avila, San Luis Obispo County, on the Marre ranch in 1929 by the Van Bergen - Los Angeles Museum party indicates close contacts between the northernmost groups of Chumash and their neighbors to the northeast in the lower San Joaquin Valley.

The distance across the Coast Range to the villages of the Yokuts is relatively short and access to the desert areas of the Mohave sink via the Walker and Tehachapi passes from the Yokut country was easier still for venturesome aboriginal traders.[7]

Our archeological history of California is yet to be written. Such little instances as these beads, the knowledge that there were primitive steatite quarries other than those on Catalina Island, which for so many years were popularly supposed to be the only sources of supply of that material; the sporadic occurrence of well-made, diorite axes of Hohokam manufacture from the far-away Gila River (one in the Los Angeles Museum was found on a site in the hills near Calabazas, Calif.); the presence of fragments of Hohokam pottery on a site four miles from Wilmington, Calif., now deposited in the Los Angeles Museum; the knowledge of old trails crossing the mountains from the desert to the sea shore, and historic references to such trade, all serve to illustrate our acute lack of ready information concerning the archeological history of California.

North of the immediate region of the Santa Barbara Channel our archeological knowledge of the California coast line is virtually nil. The interior sites are even less known. Until years of careful, systematic excavation are done and the results checked with known historical and ethnological facts, all of our knowledge of possible tribal migrations and cultures will be based largely upon data obtained in late years from the almost vanished remnants of once powerful tribes, which in some instances are not too valid.

---

[7] Farmer, Malcom. The Mojave Trade Route. The Masterkey, v. IX, no. 5, September, 1935.

Reverting to the fluorite beads once more, it will be noted that the mineral tends to shade from a colorless substance through varying bluish and purplish shades to green and opaque white.

Exposure to the air tends to diminish the strength of the color, hence some beads may be found that will be only slightly tinged with purple. Others may be discovered having a green cast to them.

However, the excavator should have no trouble distinguishing these stone beads from glass trade beads, for, aside from the texture and coloring, the drilling of the holes through such ornaments is recognizable at a glance as being of native origin.

The holes are characteristically indigenous, having been made with the ever variable stone drill which produces a tapered irregular hole and the sides of the hole indicate quite plainly the striations caused by the irregularities of the drill point. On the whole, however, the drilling in the samples of beads in my possession indicates careful workmanship. The artizans evidently worked slowly and evenly and the holes, drilled from opposite ends of the bead as is almost the invariable rule of a native drilled object, are straight and fairly even in their diameters. The beads are well polished, but are not as glossy in appearance as ordinary glass beads, or as gleaming and lustrous as the usual run of serpentine beads.

The beads vary in size. The three examples in my type collection range from (the largest) ⅝-inch in length and ⅜-inch in diameter in the middle to the smallest which is $\frac{5}{16}$-inch in length and ¼-inch in diameter. These are about the average extremes of the fluorite beads. Measurements may vary slightly but variations of such ornaments is of slight importance one way or the other.

A NEW LAND SHELL FROM THE RIVERSIDE MOUNTAINS, COLORADO DESERT

By G. Willett

Micrarionta immaculata sp. nov. (Plate 1, figs. *a, b, c.*)

Description: Shell small, depressed, umbilicated. Color white, with brownish apex; unbanded. Nuclear whorls papillated in diagonal rows, as in the *M. rowelli* group, these papillations gradually becoming less distinct and showing mostly on growth lines, practically disappearing on last whorl and base.

Aperture oblique, almost circular. Outer lip descending at insertion; inner lip encroaching slightly on the open umbilicus.

Type, No. 1051 Los Angeles Museum, together with nine smaller living specimens and seventy-five dead ones, collected by the writer and his wife, on the east slope of Riverside Mountains, Riverside County, seven miles south of the town of Vidal, San Bernardino County, Calif., March 24, 1937. Paratypes in Academy of Natural Sciences of Philadelphia and collection of the writer.

Measurements of type: diam., 12.3; alt., 7.2 mm. The largest specimen (dead) measures 13 x 7.3 mm. Two juvenile examples show faint traces of a very narrow brown band; the others of the series are immaculate. One living specimen lacks the brownish apex, being white throughout.

Of the known races of the genus, *immaculata* appears nearest to *M. mccoiana* Willett, but it differs from that shell in its pure white coloration and lack of color band. It is smaller and much whiter than *M. rowelli desertorum* Pilsbry and Ferriss, from near Parker, Ariz.—Los Angeles Museum, Los Angeles, Calif.

a. *b.* *c.*

PLATE 1

Micrarionta immaculata Willett, Type.

a. Top. *b. Side* *c. Base.*

TWO NEW FORMS OF PAPILIO RUDKINI

By F. H. Chermock and R. L. Chermock

As a preliminary problem to our work on revising the North American *Papilios*, we were confronted with the relationship that *Papilio rudkini* (Comstock) bears to certain other North American *Papilios*, namely *bairdi* and *asterias*, and their forms. Through the generous, unselfish coöperation of Dr. John A. Comstock, we were able to obtain specimens to compare with the types of *bairdi* and forms housed at the Carnegie Museum. The advice and kindness of the Curator of the Department of Entomology, Dr. Hugo Kahl, has repeatedly proven invaluable, and we here express our deep appreciation to both of these men. We have, after considerable study, reached the conclusion that although *P. rudkini* is related to *bairdi* and *asterias*, it deserves specific ranking. We find that in *rudkini*, there are forms which parallel the forms of *bairdi*, but maintain those characters which separate the two species and find it desirable to describe these two forms at this time. One of these we wish to name in honor of our friend Dr. Austin Clark, whose work in the field of North American *Papilios* has proven to be of great assistance, especially in the lesser known forms. The other we wish to name after Dr. John A. Comstock for his many kindnesses, and his active work with the species.

Papilio rudkini form Clarki f. nov.

Male. Primaries:

Upper surface: Fringes black at nervules, yellow between; a submarginal row of nine ovate spots, the two nearest the inner angle sometimes fused together forming an elongated spot. In the inner half of the limbal area is another band of yellow spots, those between the median nervules being ovate, and the two nearest the inner margin being angular. There is a small yellow spot near the costa internal to the inner limbal band. Occasionally there is a small yellow bar at the apex of the cell. The rest of the wing is black.

Under surface: Similar to the upper surface except for slight shading of orange on the inner row of spots.

Secondaries:

Upper surface: Fringe same as in the primaries. There is a row of six small, yellow, submarginal lunules, and an eye spot at the inner angle with rufous above the black point, and yellow below. The wide limbal black band has only a sparce sprinkling of blue scales. In the outer discal area there is a row of yellow spots forming a band; the yellow spots outside the apex of the cell are greatly reduced or lacking. The basal area is black.

Under surface: Similar to the upper surface, but the blue in the limbal area is more pronounced, and the submarginal lunules are yellow except for an occasional bit of orange on the first lunules. A slight shading of orange is also present on the inner band of spots.

The antennae are black, and so are the legs. The body is black with lateral rows of yellow spots.

The female differs from the male, in that the inner row of yellow spots on both wings are much smaller, or sometimes entirely absent. On the secondaries of the female, the submarginal lunules tend to disappear. There is a heavy flecking of blue in the broad limbal band. The undersurface is similar to the upper surface, except for the distribution of orange as in the male.

This form can be easily separated from *P. bairdi,* in that the inner limbal row of spots on the primaries are all angular in *bairdi,* and there is a narrow or absent black bar between the eye at the inner angle of the secondaries, and the blue above it. In *clarki,* this black band is very broad. The submarginal lunules in *bairdi* are very large and quadrate, forming an almost continuous yellow band on the undersurface of the primaries. In *clarki,* these spots are small and oval. *P. asterias* is a much larger species than any of the *rudkini* group.

The first four submarginal lunules on the lower surface of the secondaries in *P. asterias* are a bright orange. In *clarki* they are yellow except for the occasional orange shading on the first spot. This characteristic will immediately separate *rudkini* and forms, from any forms of *P. asterias.*

Holotype male. Ibanpah Mts., Calif., September 9, 1934.

Allotype female. Ibanpah Mts., Calif., August 29, 1935, ex pupa.

Paratypes Nos. 1-22 taken at Ibanpah Mts., Calif., from September 9, 1934 to May 15, 1936. Nos. 23-24 taken in Clark Mt., San Bernardino Co., Calif., July 6, 1936.

Papilio rudkini form Comstocki f. nov.

Papilio rudkini comstocki has the same general specific characteristics of typical *rudkini* and the form *clarki*. It differs from *rudkini*, however, in that the inner row of yellow spots is usually reduced in size, and on the secondaries do not extend into the basal area. The basal area is black. *Comstocki* can be separated from *clarki*, in that the inner row of yellow spots extend into the inner discal area, and the body is laterally striped with yellow spots faintly visible where the yellow stripe meets the black. *Clarki* has no lateral stripes on the body. *Comstocki* is not sexually dimorphic as *clarki*.

Comstocki bears the same relationship to *clarki* as *Papilio bairdi hollandi* bears to typical *bairdi*.

Holotype male. Clark Mt., Mojave Desert, Calif., September 10, 1936.

Allotype female. Ibanpah Mts., Calif., September 12, 1935, ex pupa.

Paratypes Nos. 1-9, Ibanpah Mts., Calif., September 9, 1934 to October 1, 1935. No. 10, thirty-eight miles east of Baker, Calif., September 10, 1934. No. 11, Clark Mt., San Bernardino Co., Calif., July 19, 1936.

The holotype and allotype of the above new forms will be deposited in the collection of the Southern California Academy of Sciences. Paratypes are in the collections of both authors, and the Southern California Academy of Sciences.

The authors here wish to thank the various persons who are assisting them in the revision of North American *Papilios*, and will appreciate any assistance, and information given them by other workers in the field. We are extremely desirous of receiving data pertaining to distribution, variation, life histories, etc. of North American *Papilios*.

TWO NEW RACES OF PAPILIOS FROM MANITOBA

By F. H. Chermock and R. L. Chermock

Papilio machaon race Avinoffi r. nov.

Expanse: Constant at or near 2⅝ inches.

Upper surface:

Primaries: Fringes are black at the end of the nervules with yellow between. A submarginal row of eight yellow spots is present, and internal to this is a wide black area well flecked with yellow. In the inner half of the limbal area is a broad band of yellow spots progressively becoming larger and longer toward the inner margin. The outer edges of these spots are square edged, and in some cases concave. The inner edge of this row of spots form a straight line. The basal area is heavily flecked with yellow. There is a yellow crescent-shaped spot at the apex of the cell, and another similar yellow spot internal to this, but smaller.

Secondaries: Possessing a submarginal row of yellow, lunate spots; a wide black band internal to this is very heavily flecked with blue to form blackish-blue, inter-venal spots. The discal and basal area is yellow except for the thin black lines along the veins, and black inner margin of this area. The rufous spot at the anal angle is bounded inwardly by blue. There is no black present between the blue and the rufous color. The rufous is limited outwardly by a black band extending from the inner margin and separating the rufous from the yellow. This line ends in an oval shaped termination.

Lower surface:

The primaries are similar to the upper side and differ only by having yellow present a little more strongly.

The secondaries also are similar to the upper surface except for the blue, which becomes very limited, and the original blue is replaced by a sprinkling of greenish yellow scales.

The body is black on the dorsum, with two lateral yellow lines. The ventral surface is black, with a narrow yellow line following the median line. The legs are black with a few yellow hairs. Antennae are black.

Avinoffi may be separated from its North American relatives of the *machaon* group by having the inner edges of the inner row of yellow spots forming a straight line. *Papilio machaon hudsoniana, petersi,* and *aliaskae* have an angle in the inner edge of the inner row of yellow spots, whose vertex is on the first median nervule.

Holotype, Whirlpool River, Riding Mts., Manitoba, June 14, 1936.

Paratype No. 1, Whirlpool River, Riding Mts., Manitoba, June 14, 1936. No. 2, Whirlpool River, Riding Mts., Manitoba, June 16, 1933. No. 3, Whirlpool River, Riding Mts., Manitoba, June 11, 1933.

The holotype will be deposited in the Carnegie Museum.

We take great pleasure in naming this *Papilio* after Dr. Andre Avinoff, Director of the Carnegie Museum, Pittsburgh, in recognition of his work in the *machaon* group. It is on his advice that this form is being named.

PAPILIO NITRA form KAHLI f. nov.

Expanse: Males about 2½ inches, females average slightly larger.

Male:

Upper surface: The inner row of yellow spots are the same shape as in typical *nitra*, but are slightly shorter. The outer row of yellow spots in typical *nitra* are rectangular; in *kahli,* they are more rounded. The black point in the rufous spot at the inner angle of the secondaries is joined to the inner margin by a thin band of black as in the *machaon* group. The black between the rufous spot and the blue is very narrow, or entirely absent.

Under surface: The yellow spot in the cell of the secondaries is slightly smaller than on the upper surface. The only orange occuring on the marginal and submarginal spots in *nitra,* occurs on the first marginal lunule of the secondaries. In *kahli,* there is orange on the inner row of spots on the secondaries which exist in varying quantities.

Female:

Papilio nitra kahli has a dimorphic female as in *bairdi* and *asterias.* It differs from the typical *nitra* female in having all of the yellow spots reduced. The yellow in the cell of the secondaries of typical *nitra* is lacking in this form. However, there is one specimen in the series having a faint indication of this spot. The orange on the under surface of the secondaries is similar to the male. The black point in the anal rufous spot is connected to the inner margin of the secondaries.

Papilio nitra kahli can be immediately separated from *nitra. Papilio nitra* has a narrow yellow line, with no spots present on the abdomen. *Kahli* has rows of yellow spots which sometimes tend to fuse together to form an interrupted yellow line; however, the characteristic yellow spots are still present. This form has the short tail characteristic of typical *nitra* and the *machaon* group.

Holotype, Riding Mts., Manitoba, June 13, 1933.

Allotype, Riding Mts., Manitoba, June 11, 1933.

Paratypes Nos. 1-7 males, Nos. 8-11 females. All are from Riding Mts., Manitoba between June 4 and June 21 from 1933 to 1936. The holotype and allotype will be deposited in the Carnegie Museum in Pittsburgh.

We are naming this *Papilio* in honor of Dr. Hugo Kahl who has graciously permitted us to compare this form with Edward's types of *Papilio nitra* and has extended us many other favors too numerous to mention.

LIFE HISTORY OF PAPILIO RUDKINI COMST.

By John A. Comstock and Charles M. Dammers

This species, which is closely related to *P. bairdi brucei,* is widely distributed over the Mojave and Colorado deserts, and the eastern slopes of the southern Sierras, wherever its foodplant, *Thamnosma montana* Torr. & Frem., occurs.

It was first described by the senior author in Bull. So. California Academy of Sciences, Vol. XXXIV, Part 2, p. 143, 1935, and further analysis of its relationship is given by F. H. and R. L. Chermock in a prior portion of this present issue.

A large quantity of larvae were secured in September, 1934, at the south end of Clark Mt., San Bernardino Co., Calif., and lesser numbers were subsequently taken at various points in the near vicinity. When removed from the Turpentine Broom (*Thamnosma*) these larvae readily accommodated themselves to *Foeniculum* (Fennel), on which they were raised to maturity.

Egg. Spherical, the surface smooth; slightly flattened at base. The color is dull yellow, with a slight suggestion of an irregular brownish collar becoming evident on the second day.

An egg laid September 9 hatched September 13.

Larva, first instar. Length, extended, 5 mm.

Ground color, black. There are six longitudinally placed rows of short stout branching spines, one spine to a segment in each row. The upper four rows are a solid black on the shafts and accessory hairs. The lower two rows differ in having soiled orange shafts, with black accessory hairs. On the sixth segment, at the base of the uppermost spine on its lateral margin, there is a lemon-white crescentic mark. On the seventh segment a larger

spot of the same color occurs, but the color also extends onto the spine. On the eleventh segment there is a circlet of the same color at the base of the spine.

On the second to sixth, tenth and eleventh segments, dorso laterally placed, there is a lemon patch on the anterior portion of the segments. These are single on each segment except for the first, which has two, placed one above the other, and the seventh, where there is an additional patch of yellow at the posterior edge of the segment.

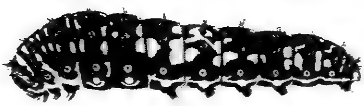
Around the base of the uppermost spine on the seventh segment there are a few lemon-yellow dots.

Across the top of the first segment there is a large soiled-orange scutellar blotch.

Abdomen, black. Head, black, with a few short black hairs. Legs, black. Prolegs, black with lemon-white claspers. Spiracles black.

The body surface is entirely covered with minute short black hairs. See Plate 2, fig. A.

A.



B.

PLATE 2

Larva of *Papilio rudkini* Comst., first and second instars.

A. First instar, enlarged approximately x 5.

B. Second instar, enlarged approximately x 2½.

Reproduced from painting by Comm. C. M. Dammers.

SECOND INSTAR. Length, extended, 19 mm.

Ground color, black. The six rows of branching spines are still present, although the lowermost row is modified to the extent that only the four anteriorly placed are true spines, the remainder being merely bunches of black hairs.

All of these spines are black. At the base of each spine on the uppermost row is a crescentic orange spot, medially placed. This is lacking, however, on the first segment.

A somewhat similar spot occurs at the base of each spine in the second row, but its position is caudal and slightly superior to each spine.

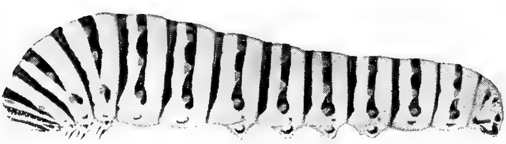
In the lowermost row of spines each is completely encircled at its base by an orange disc.

The body has a considerable number of white spots of varying sizes and shapes, scattered over its surface. Figure B of Plate 2 accurately depicts these.

Legs, abdomen and spiracles, black, as in the previous instar. Prolegs, black, with white claspers.

Head, black, with a lemon-yellow inverted V on the front of the face. The body is completely invested with a covering of minute black hairs.

A.



B.

C.

PLATE 3

Larva of *Papilio rudkini* Comst.

A. Third instar, enlarged x 2.

B. Mature larva, light form, enlarged approximately x 1½.

C. Mature larva, dark form, enlarged approximately x 1½.

Reproduced from painting by C. M. Dammers.

THIRD INSTAR. Length, extended, 28 mm.

Body, black and free of all spines and hairs except for a few minute black hairs over the abdominal area.

The position of the former spines is now occupied by orange ovoid or round spots. Across the forepart of each segment there is a narrow lemon-yellow band. Paralleling these on the rear part of each segment occurs a narrow white band.

Inferior to each of the lowermost orange spots on the segment occurs an irregular semilunar white spot. The arrangement of these various spots and bands may be seen by referring to Figure A of Plate 3.

Head, black, with an inverted lemon-yellow V on the face and a divided narrow white band on each side.

Abdomen, black. Legs, prolegs and spiracles as in previous instar.

MATURE LARVA. Length, extended, 42 mm.

There are two color phases of the mature caterpillar—one in which white predominates and the other, which is very dark. Intergrades occur, between these two forms, one of which is shown on Plate 4.

DARK TYPE. Ground color, black. There are six longitudinal rows of round orange spots corresponding to the positions of the former spines.

Along the front margin of the first segment occurs a narrow white band with two orange patches superimposed on it, on each side. On this same segment, arching transversely across the top and placed near the posterior edge, is a narrow white band. On the second segment, a transverse white band arches entirely across the segment just anterior to the orange spots. Similar bands occur on the third and fourth segments, but are discontinuous in the mid-dorsal area.

The rear folds of the second and third segments are bordered with white.

On the fourth to caudal segments a transverse white band occurs near the hind margin of the segment. This band is interrupted over the dorsum.

On the fifth to tenth segments a white elongate spot occurs anterior to each spiracle. This spot on the tenth segment is continued as a white bar up over the dorsum.

Inferior to the lowermost row of orange spots there is a longitudinal wide white band. On this band, from the fourth to the eleventh segments, there is superimposed on each segment, a black spot. Such other minor details of marking as are not here noted may be seen in the accompanying cut, Figure C of Plate 3.

Head, abdomen, legs, prolegs and spiracles as in third instar.

WHITE TYPE. Ground color, soiled white. Six rows of round orange spots occur, as in the dark form. These are obsolescent on the first and caudal segments.

The first segment has two orange spots on each side, placed well forward on the segment. The caudal segment has one orange spot placed subdorsally on each side. The front fold of each segment (except the first and caudal) has a transverse narrow white band, which pinches out at the edge of the abdomen. The front fold of the first segment is soiled white, and the corresponding fold of the caudal segment bears a small black patch.

PLATE 4

Mature larva of *Papilio rudkini* Comst., feeding on *Thamnosma montana* Torr. & Frem., enlarged x 2.

Photo by the late Wm. Menke.

Transversely on each segment (except the first) in line with the round orange spots occurs a narrow black band. This continues laterally to a point just below the lowermost orange spot. There is a black dot or small stripe immediately below the termination of each band.

Legs, soiled white with black points. Prolegs, soiled white, with a black crescent laterally placed.

Abdomen, soiled white, covered with minute white hairs. Spiracles, black, with narrow white rims.

Head, soiled white with two perpendicular black bars on each side, covered with short white hairs.

This light form of the larva is depicted on Figure B of Plate 3.

Pupation took place in late September, the pupa being suspended from a silk pad attached to the cremaster, and the usual silk girdle.

PUPA. Average length, 28 mm.

There are two color forms of the chrysalis, as with many of our Papilios. These are (1) pale green and (2) pale wood-brown. The form is very similar to the pupa of *P. zelicaon,* except that it averages smaller in size and is somewhat less robust. The pupa is figured on Plate 5.

From a lot of some 450 larvae which pupated in captivity, six normal females and two dwarfed males emerged between late September and October 5, of the same year. The remainder emerged sporadically throughout the succeeding years.

PLATE 5

Pupa of *Papilio rudkini* Comst. enlarged approximately x 1¾.

Photo by the late Wm. Menke.

MISCELLANEOUS NOTES ON WESTERN LEPIDOPTERA

By John A. Comstock

Euphydryas sierra Wright.

Mr. W. N. Burdick reports this species in the Toyabe Mts., Nevada, where be observed the females ovipositing on *Mertensia ciliata* v. *stomatechoides* Jepson. Young larvae were fed on this plant but were not brought through to maturity.

Strymon adenostomatis Hy. Edw.

The mature larva and pupa of this species was described in the Bull. So. Calif. Acad. of Sciences of September, 1935, Vol. XXXIV, Part 3, page 211. At that time the egg was unknown.

We have recently received from Comm. Dammers a cluster of eggs, laid on the upper surface of a leaf of the foodplant, *Cercocarpus betuloides,* Nutt.

These were collected by Mr. Chris Henne, who captured a female in Little Santa Anita Cañon, Monrovia, Calif., on June 28, 1936, and confined her over the foodplant.

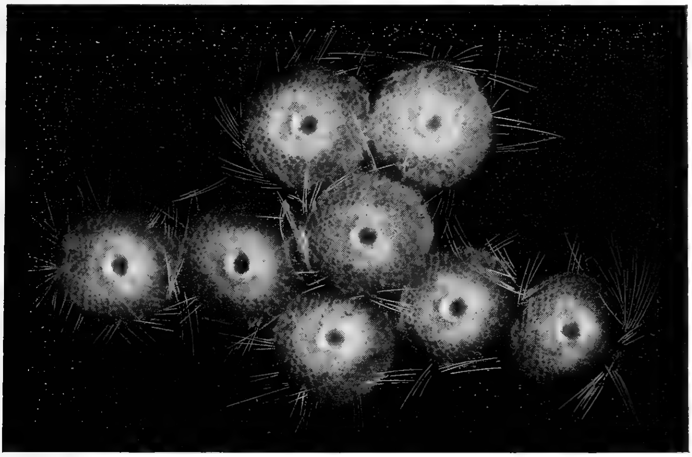


PLATE 6

A cluster of eggs of *Strymon adenostomatis* Hy. Edw. magnified x 20.

One of the characteristic features of this group of eggs is that each egg is surrounded in a more or less regular manner by a circlet of long hairlike scales derived from the caudal end of the female's abdomen. This gives the mass of eggs an appearance of having acquired a growth of mold. An examination of the females in the region of the ovipositor discloses a very heavy investiture of these light tan colored hairs.

EGG. .82 mm. in diameter x .4 mm. high.

Echinoid, white. Micropyle depressed, .15 mm. in diameter, with a crater-like rim. The surface is covered with a reticulation of hexagonal cells, or pits, having raised walls, the junctures of which are not tipped with projections as in many of the Lycaenid eggs.

These cells are largest on the outer circumference of the egg, and become progressively smaller as they approach the micropyle. Plate 6 figures a group of eight of these eggs, viewed from their superior surfaces.

The earlier instars of the larva remain to be described and figured.

PLATE 7

Mature larva of *Enargia decolor* Wlk., on leaf of aspen. Enlarged approximately x 3.

Photo by the late Wm. Menke.

ENARGIA DECOLOR Wlk.

Larvae of this species were found in the White Mountains, Arizona, near the town of Greer, in June, 1935, feeding on Quaking Aspen. They were nearing maturity at that time.

The larva hides itself between two leaves, weaving a tight enclosure, in which it rests in a curled-up state during the day. In captivity specimens were successfully raised on Lombardy Poplar.

The mature larva measures approximately 32 mm. Head, soiled ivory, with a delicate whitish reticulation over the center of each cheek. It is relatively flat, and bears a few white hairs. Ocelli black. Mouth parts tinged with brown.

Body, ground color green, of a semi-translucent quality. In the median line there appears to be a discontinuous longitudinal dark green line, but this is actually due to fluids passing through a tube-like structure, the movements of which are visible through the skin.

There is a delicate white longitudinal submedian line, and a double line of similar character in the region of the stigmata.

A. B. C.

PLATE 8

Pupa of *Enargia decolor* Wlk., enlarged x 3½.

A. Dorsal view. B. Lateral view.

C. Ventral view.

Photo by the late Wm. Menke.

Legs concolorous with body, the tips slightly darker. Prolegs and anal prolegs also concolorous with body.

The abdomen is colored the same as the dorsum.

Stigmata, cream, with a delicate narrow brown marginal rim. The mature larva is illustrated on Plate 7.

The pupa is formed in the silk nest occupied by the larva.

Length, approximately 19 mm. Color, brown.

There are no unusual structural features. The surface is thinly covered with a whitish bloom which easily rubs off.

There are no setae or hairs on any part of the body except for a few very minute dark hairs on certain regions of the abdominal segments, discernible only with a lens.

The cremaster bears two medium long and two short curved hooks.

The pupa is pictured on Plate 8.

Imagos emerged July 29, 1935.

PLATE 9

Larval case of *Thyridopteryx meadii* Hy. Edw., enlarged.

THYRIDOPTERYX MEADII Hy. Edw.

This interesting Psychid occurs in great abundance in the regions of the Mojave Desert north and east of the town of Mojave.

This was described by Henry Edwards in Papilio, I, 116, 1881, from the "Mojave Desert." No record of foodplant was given, and no illustration of the larval case, the latter a most important feature. See Plate 9.

The species feeds on the Creosote Bush, *Covillea glutinosa* Rydb. Fully developed cases may be found in May and June. The females are wingless and remain in their cases throughout life.

Two parasites have been recovered: a dipterous species, *Phorocera tachinomoides,* Touns., determined by Aldrich, and a hymenopterous species in considerable numbers which was kindly determined for us by Cushman as *Allocota thyridopterigis* Riley.

A REMARKABLE INSTANCE OF FOOD-PLANT SELECTION BY A BUTTERFLY

By C. M. Dammers

In my garden on the outskirts of the town of Riverside, Calif., U. S. A., I have most of the native Milkweeds (Asclepiadaceae) growing, among which are two quite large patches of *Philibertia heterophylla* Jephson, a tender small-leaved climbing plant, which is the plant of choice for The Striated Queen, *Danaus berenice strigosa* Bates, to lay her eggs on in Southern California. During the summer and autumn months of 1935 this butterfly was continually in my garden, and I watched the females laying on the *Philibertia* and collected the eggs and brought them through to imagos. I never saw the females visit any of the other milkweeds, so you can imagine my surprise when one afternoon I saw a female come to a plant of *Stapelia* (Carrion Flower) in a pot on my porch which is quite a distance from the other milkweeds. She laid an egg and the larva from it grew to maturity on the plant. (See illustration, Plate 10.)

Now *Stapelia* in appearance is a succulent or cactus-like plant and its flowers have an odor like putrid meat. It is imported from South Africa and is generally grown by cactus and suculent enthusiasts and to an ordinary observer, until it flowers, could in no way be connected with the milkweeds.

I was unable to observe where the baby larva started to feed but finally it ate off the thick juicy ends of the plant. I have since tried with several new-born larvae of the Queen to get them to feed on this plant with no success. Now the question arises as to what sense guided this butterfly away from her natural foodplant to such a remote member of the same family.

Apropos of this I have seen *Pieris rapae* L. lay her eggs on Mignonette which only some of the botanists place in the order Cruciferae.

PLATE 10

A potted plant of *Stapelia* showing the larva of *Danaus berenice strigosa* Bates feeding on the uppermost leaf.

CALIFORNIA PINE TIP MOTHS OF THE GENUS RHYACIONIA

By W. Harry Lange, Jr.
University of California

The larvae of the genus *Rhyacionia* are feeders on the buds and new growth of various species of pines, forming resinous exudations; but never pitch nodules as in the genus *Petrova.*

We find in the literature mention of a single species infesting the buds of pines in California. The present study, however, has shown the existence of two species, *Rhyacionia pasadenana* (Kearf.) confined to Monterey pine and other pines along the coastal areas of California and *Rhyacionia zozana* (Kearf.) confined primarily to ponderosa pine and Jeffrey pine of the Sierra Nevada. Specimens of the former species reared from Monterey pine, *Pinus radiata* Don., were compared with specimens of the type series by Carl Heinrich and were found to be unquestionably this species. Specimens of the latter species reared from ponderosa pine, *Pinus ponderosa* Lawson, were compared with the type of *Petrova zozana* Kearf. in the American Museum by Carl Heinrich and a female found to agree in every detail with the Kearfott type. This makes it necessary to transfer *Petrova zozana* Kearf. to *Rhyacionia,* and makes *Rhyacionia montana* (Busck) at the most, a variety or race of *zozana.*

Rhyacionia pasadenana (Kearfott).

This species is distributed along the coastal areas of California from Marin County on the north to Los Angeles County on the south where the larvae may be observed from October to March feeding in the buds of Monterey pine and other pines planted as ornamentals. During the present study it has been found on *Pinus radiata* at San Francisco, Stinson Beach, Berkeley, Oakland, Pescadero, Carmel and Point Lobos; at San Francisco on *Pinus contorta* and *P. muricata.*

Description of Egg: Average length 0.704 mm., average width 0.528 mm., average heighth 0.357 mm. Color pale yellowish. Semi-spherical in outline; flattened beneath, convex above; often overlapping like fish scales. Surface finely reticulated. (See Plate 11.)

PLATE 11

Eggs of *Rhyacionia pasadenana* (Kearf.) on needles of *Pinus radiata.* X 5.

Description of Larval Instars:

First Instar: Length 1.36 mm. Color pale yellow. Head dark brown; noticeably wider than body. Prothoracic shield light brown. Setae light colored; under magnification minute secondary setae seen. True legs and pro-legs concolorous with body.

Second Instar: Length 2.33 mm. Color yellowish-brown. Head and shield dark brown. Rest as in first instar.

Third Instar: Length 4 mm. Rest as in second instar.

Fourth Instar: Length 5 mm. As in third instar, except true legs show darker areas and anal plate dark brown.

Fifth Instar: Length 7 mm. Color yellowish-orange. Head, shield and anal plate dark brown. True legs with darker areas; pro-legs concolorous with body. Crochets of first four pairs of pro-legs uniordinal. Secondary setae evident.

Sixth Instar: Average length 9.3 mm. Color yellowish orange. Secondary setae very evident. Rest as in fifth instar.

Head Capsule Measurements:

Field and laboratory rearings indicate six larval instars on the basis of head capsule measurements, using Dyar's Law. Numerous specimens were examined for each measurement.

INSTAR	CALCULATED WIDTHS IN MM.		OBSERVED WIDTHS IN MM.
First - - - -	....		.21
Second - - -	(.21 x 1.28)	.27	.27
Third - - - -	(.27 x 1.28)	.35	..
Fourth - - -	(.35 x 1.28)	.45	.41
Fifth - - - -	(.45 x 1.28)	.58	.59
Sixth - - - -	(.58 x 1.28)	.74	.78

Description of Pupa:

Length 6 mm.; greatest width 1.5-2 mm. Head, thorax and wing cases dark brown. Abdomen reddish-brown. Abdominal segments 2-7 with two rows of dorsal spines. Cremaster with hooked setae. (See Plate 12.)

Life History and Habits:

In the laboratory eggs were laid on the needles singly or in groups of 2-10. It was not uncommon, also, to find them securely attached to the glass sides of the rearing cages. The incubation period under laboratory conditions was 7-9 days. The larvae after emerging immediately started to migrate. Feeding was first confined to the bases of the needles within the needle fascicles and later the larvae mined into the buds. No larvae were reared beyond the third instar in the laboratory.

On March 6, 1936, adults were placed in a cage with a terminal of Monterey pine. At 7:25 P. M. two pairs were observed mating on the foliage. In mating the abdomens were brought together, the wings being held roof-like over the body and the antennae back. By 8:30 P. M. copulation was completed. On March 9 eggs were found laid on the needles and glass sides of the cage. A record of oviposition was recorded at 9:00 P. M.

A. B. C.

PLATE 12

Pupae of *Rhyacionia zozana* and *R. pasadenana.*

A, B. Dorsal aspects of pupae of *Rhyacionia zozana* (Kearf.) enlarged x 9.

C. Lateral aspect of pupa of *Rhyacionia pasadenana* (Kearf.) enlarged x 6.

Other caging experiments of adults gave similar results with the adults living about 10 days.

The length of the first, second and third instars under laboratory conditions were recorded at 7 days each. This would indicate a larval period of approximately 40 days under these conditions. Field data indicated, however, that this period is several times longer under natural conditions with climatic factors greatly influencing the duration of the various stages. The pre-pupal period in the laboratory based upon 16 records showed a maximum of 13 days, a minimum of 2 days and an average of 5.12 days. The pupal period for 33 individuals under the same conditions indicated a maximum of 40 days, minimum of 14 days and an average of 29.39 days.

Pupation occurs in the larval burrows of the bud or new growth, with practically no cocoon being formed. The exudation of wax is often used in making the pupal cell. In emerging through the buds the pupal case is forced outwardly by the adult and can be seen projecting from the bud. (See Plate 13.) Flight occurs at night as does egg deposition. Adults in the laboratory live from 7-16 days without food.

PLATE 13

Empty pupal cases of *Rhyacionia pasadenana* (Kearf.) projecting from buds of Monterey pine. X 2¼.

Natural Enemies:

Admontia retiniae Coq. This tachinid parasite is the most widespread and commonest of the natural enemies of the larvae. An average of 18-20% parasitism is found with as high as 90% not being uncommon. The larva is 4.5 mm. in length, tapering anteriorly and posteriorly and of a yellowish-white color. The cocoon is 5.0 - 5.5 mm. in length, 2.0 - 2.8 mm. in width and of a dark reddish-brown color. Cocoons of this parasite are found in the larval burrows, one to a larva. The pupal stage under laboratory conditions lasts 12-16 days.

Dicladocerus sp. A series of this small green hymenopterous parasite were reared from material collected at San Francisco, Calif., January 7, 1936. Adults emerged through the pupae, several to a pupa. The pupa of this species is 3 mm. long, 1 mm. wide and a light brown in color.

Ageniaspis sp. (Close to the European *A. fuscicollis* Mayr. according to A. B. Gahan). A few specimens of this species were recovered from material collected at San Francisco, Calif.

Epiurus aplopappi (Ashm.). Adults of this species were reared from material collected at several localities. The larvae are attacked, with one parasite to a larva occurring.

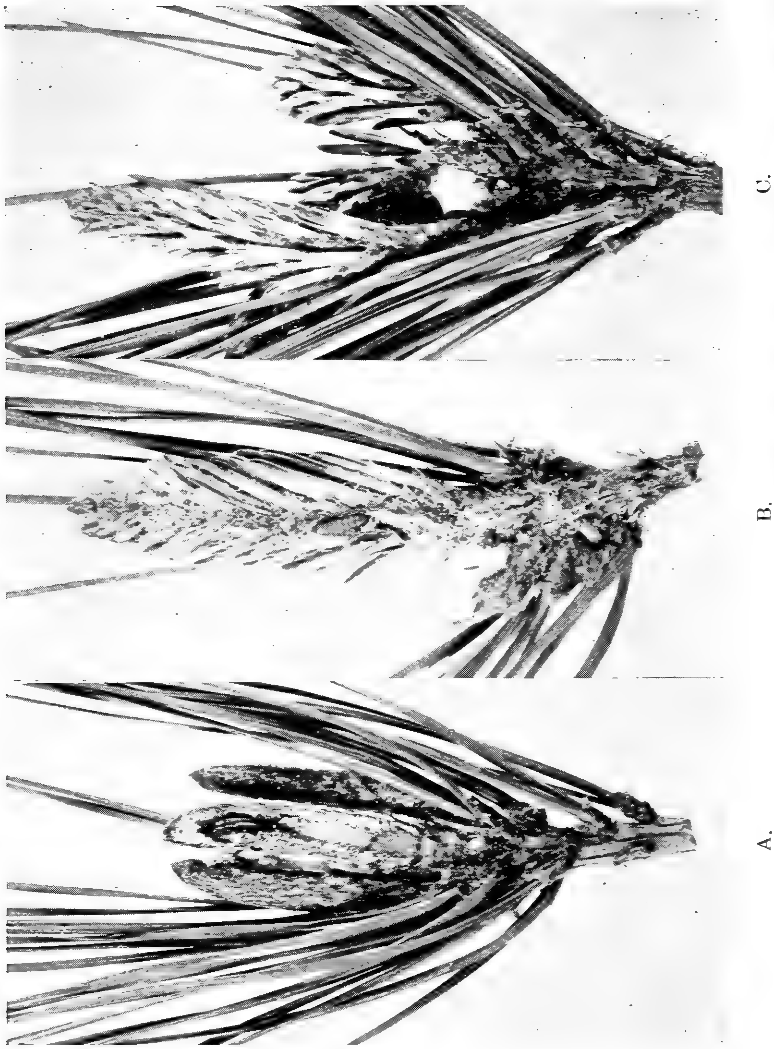


PLATE 14

Rhyacionia pasadenana (Kearf.) slightly reduced in size.

A. Empty pupal case in damaged bud.
B. Pre-pupal larva in bud.
C. Exudation of pitch caused by activities of larva.

Nature of Injury: The larvae feed chiefly on the buds and new growth of pines. Feeding during the growing season often causes a curving or complete killing of the bud. Young trees are preferred for attack and permanent disfigurement may result. A very heavy infestation is necessary to cause any permanent injury to Monterey pine because of the ability of this tree to send out additional buds. The damage to *Pinus contorta* and *P. muricata* is usually more serious. (See Plate 14.)

Seasonal Activity: Mature larvae may be found in the field from October to March, adults emerging in April-June. No evidence of a second generation is found. The migration of mature larvae from old buds to new buds may be seen during February. Larvae continue their development during the summer on the buds and new growth and by October are mature. Pupation occurs during February to March. An overlapping in the single generation is quite evident, with climatic factors playing a great part in determining the seasonal activity of this insect.

Rhyacionia zozana (Kearfott).

In contrast with the coastal distribution of *R. pasadenana* this species is found infesting ponderosa and Jeffrey pine of the Sierra Nevada. Other species of pines when set out within the range of this species as nursery stock or as ornamentals may also be attacked. It has been found attacking ponderosa pine at Placerville, Eldorado County, Modoc National Forest, and Stanislaus National Forest. A record of it on Jeffrey pine in the Sierra National Forest is available.

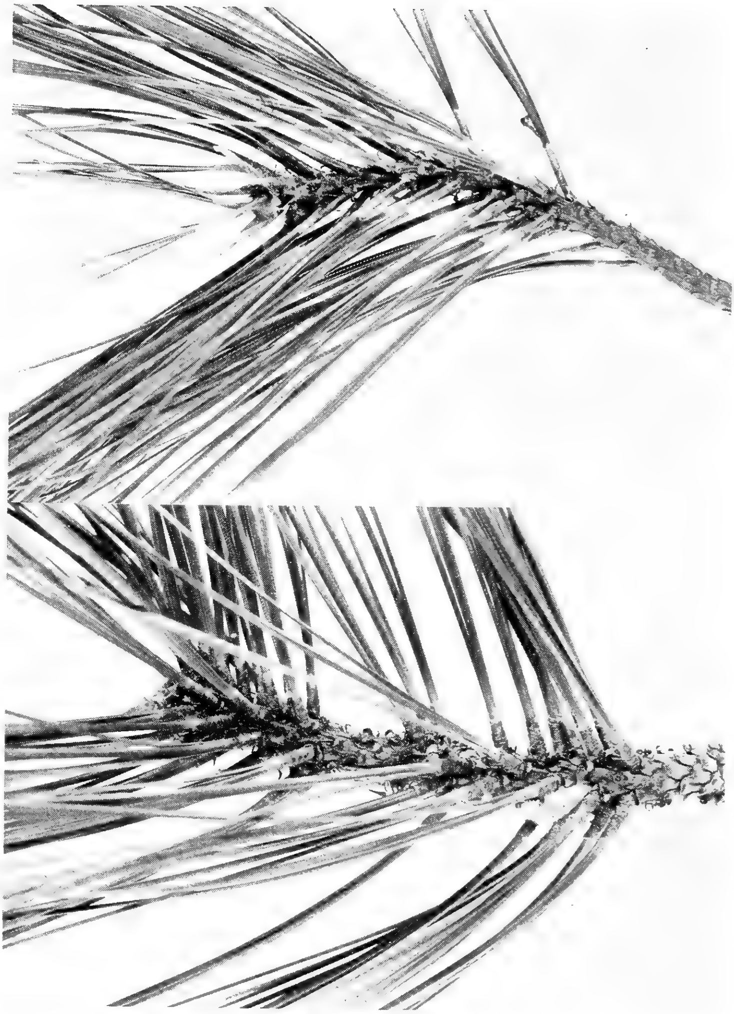
The biology of *zozana* is not completed, but a description of the known stages is given.

Mature Larva: Length 12 mm. Color orange-brown. Head, shield an anal plate reddish-brown. Width of head capsule 1.1 mm. Setae light colored and setigerous tubercles inconspicuous. Crochets of first four pairs of pro-legs uniordinal. Body clothed with minute secondary setae.

Pupa: Length 6-7 mm.; greatest width 2.0-2.5 mm. Head, thorax and wing cases, glossy, very dark brown. Abdomen dark reddish-brown. Abdominal segments 2-7 with two rows of rather large pointed spines on the dorsal surface. Posterior end rather truncate and cremaster with hooked setae. (See Plate 12, A-B.)

Life History and Habits:

No laboratory rearing of *zozana* was successful. During the summer of 1935 a large cage was placed over several young trees of *Pinus ponderosa* at the Institute of Forest Genetics at Placerville, Calif., and infested tips introduced. On November 17, 1935, pupae were found in the infested tips and some on the stems of the caged trees. No pupation in the duff or ground was found. (See Plate 15, A.)



B.

A.

PLATE 15

Rhyacionia zozona (Kearfott), reduced approximately ½.

A. Cocoon on lateral shoot of *Pinus ponderosa.* The bud has been completely killed by the larva.

B. Work of a larva on a shoot of *Pinus ponderosa.* The bud has been killed.

Mature larvae appear during June at which time their damage to pine reproduction is most noticeable. Pupae overwinter in closely woven papery cocoons, with adults emerging in April-May and depositing eggs on the needles. A single generation a year is found. Feeding of the young larvae is first noticed at the base of the needles, and later the buds are attacked. The resinous exudations caused by the borings of the larvae are characteristic of this species.

In the same locality the work of a California form of *Dioryctria delectella* Hulst may often be confused with *Rhyacionia* work. The *Dioryctia* work can be distinguished by the sawdust-like frass, a clean eating out of the bud so as to leave only the outer scales, and the more extensive workings into the new growth. The mature *Dioryctria* larvae overwinter and leave the buds about the time those of *Rhyacionia* are mature.

Infested buds of *zozana* placed in rearing under laboratory conditions showed an emergence of moths from December to February.

Nature of Injury:

Rhyacionia zozana does serious damage to pine reproduction, being especially destructive to trees occurring as dominants in the open. Nursery stock may be seriously set-back by the deforming or killing of the terminal shoots. The bud is attacked primarily, with the mature larvae often working for short distances into the new growth of the stems. (See Plate 5, B.)

Key to Adults of *Rhyacionia*:

The adults of *Rhyacionia zozana* (Kearf.) and *R. pasadenana* (Kearf.) can be separated in the following key:

Wing expanse of fore-wings 11-17 mm.; basal area of fore-wings with scales dark reddish-brown mingled with gray; hind wing and cilia grayish fuscous; male genitalia small, no finger-like process from cucullus[1] .... *pasadenana* (Kearf.)

Wing expanse of fore-wings 17-20 mm.; basal area of fore-wing with scales black and white with few reddish scales; hind wing and cilia smoky fuscous; male genitalia considerably larger, with finger-like process from cucullus[2] .... *zozana* (Kearf.)

---

[1] Heinrich. United States National Museum Bull. 123, plate 9, fig. 50.

[2] As above. Plate 9, fig. 47. (This figure of *montana* (Busck) practically identical with *zozana* Kearf.)

Acknowledgments:

The author is greatly indebted to Messrs. R. A. Cushman, A. B. Gahan, Carl Heinrich, J. M. Miller, C. F. W. Muesebeck and J. E. Patterson of the Bureau of Entomology and Plant Quarantine for determinations of parasites and for assistance in other phases of this investigation.

Mr. Clyde Berriman and Mr. Lloyd Austin of the Institute of Forest Genetics, Placerville, have assisted in rearing work. Mr. Eric Walther has made is possible to examine trees in Golden Gate Park, San Francisco.

Professor W. B. Herms, Professor E. O. Essig and Dr. Edwin C. Van Dyke of the University of California have made valuable suggestions during the course of this work.

BIBLIOGRAPHY

1. Friend, R. B. and A. S. West, Jr. The European pine shoot moth, (*Rhyacionia buoliana* Schiff.) Yale University School of Forestry. Bull. No. 37, 1933.

2. Heinrich, C. Revision of the North American moths of the subfamily Eucosminae of the family Olethreutidae. U. S. Nat. Mus. Bull. 123; 13-21; 26. 1923.

3. Kearfott, W. D. New North American Tortricidae. Trans. Amer. Ent. Soc. 33: 2-4. 1907.

NEW SCARAB GENERA FROM LOWER AND SOUTHERN CALIFORNIA (Coleoptera)

By Lawrence W. Saylor
University of California

I owe to Dr. E. C. Van Dyke and Dr. F. E. Blaisdell the opportunity of studying the present new genera, both of which exhibit rather interesting structural characteristics. The types of both are deposited in the collections of the California Academy of Sciences.

Chaunocolus Saylor, New Genus.

Facies robust-oval, pilose above. Head with an erect horn, clypeus with sides parallel, apex reflected. Thorax with two high oblique tumosities each side of middle, the surface between deeply concave; front margin thin but not membranous. Elytra much less than twice the length of the thorax, sides without membrane. Antennae 9-segmented; club 3-segmented, the segments close-fitting. Eyes from above flat, sunken, inconspicuous. Ligula free from mentum. Abdominal segments except last, closely connate, the sutures entirely effaced, the last segment free. Claws long, with a minute acute tooth at center. Front femora bidentate, apparently without an inner spur. Front coxae conical. Hind and middle tibiae with two apical spurs. All tarsi but little longer than their respective tibiae; first segment hind tarsus but little longer than second. Propygidium and fifth ventral segments not connate but separated as in *Oncerus*, the last spiracle very minute and apparently below the suture.

Genotype: Chaunocolus cornutus, New Species.

Chaunocolus cornutus Saylor, New Species.

Robust-oval, rufocastaneous with somewhat piceous tinge, strongly shining, pilose above. Head with a stout erect horn at center-base of front, the vertex and front each side of the horn impunctate and polished, along the eye margin and genae with long erect hairs; clypeal suture not obvious but surface somewhat transversely obliquely carinate at apparent position of the clypeal suture; clypeus elongate, sides parallel, apex broadly evenly rounded; apex greatly reflexed, sides slightly reflexed; clypeal disc with dense very coarse punctures, with short erect hair. Antennae 9-segmented, second segment globose, third but little longer than second, subcylindrical; fourth shorter than third; fifth and sixth segments very short and globose; club oval, subequal to segments two to six combined. Thorax with sides evenly

rounded, margin from above very finely crenulate, with very dense long yellowish cilia; front margin thin and seemingly membraneous but in reality with a fine hair margin; base finely completely margined, with short erect cilia. Thoracic disc with two high subcariniform tumosities, these tumosities running from each side of middle just in front of the base obliquely forward towards the front angles, but suddenly declivious before reaching the front angles; surface between the two oblique tumosities deeply widely concave, surface highly polished and very sparsely irregularly finely punctured, with a few erect hairs of great length; outer part of tumosities in basal half impunctate, in apical half sparsely punctured with moderately long erect hair. Scutellum smooth, entirely impunctate. Elytra about one and one-half times longer than thorax, surface subrugose, finely irregularly punctured, with uniform moderately dense suberect hair; sutural or other costae not obvious. Abdomen polished, with sparse punctures bearing very long erect yellowish hairs, the latter denser at sides; last segment plane, impunctate, apex with long cilia. Pygidium polished, very convex, surface moderately densely finely punctured, with very long erect hair; apex subrounded, ciliate. Front tibiae bidentate. Hind femora very robust, tibiae short, about twice longer than the width at apex, inner face and sides with coarse granulate punctures, with long moderately dense hairs; sides with a short oblique carina. Hind tarsi one and one-fourth times longer than tibiae, first tarsus a little longer than the second, the third to fifth successively a little shorter than each preceding segment. Length 4.7 mm. Width 2.5 mm.

The unique male *Type* is from La Paz, Baja California, Mexico, collected by G. F. Ferris on June 29, 1919.

The present genus is related to *Oncerus, Pseudacratus, Podolasia,* and *Chnaunanthus* in the mouthparts, spiracles and connate ventral abdominal segments, but may readily be separated from all by the cornute head and the concave thorax.

XEROPSAMOBEUS Saylor, New Genus.

Form elongate-oval, somewhat subparallel behind, thorax widest in apical third, body not narrower in front. Mandibles not visible from above. Clypeus grossly tuberculate. Thorax evenly convex, with no traces of any transverse ridge or sulcus; margin fimbriate with fine hairs. Elytra slightly more than twice longer than thorax, very slightly wider behind, humeral angles very prominent and thus probably with well-developed wings. Hind tibiae with two transverse ridges; hind tarsi short, only slightly triangular, first segment very slightly longer than the next two combined, total length of tarsi noticeably shorter than tibiae. Front tibiae tridentate. Characters otherwise as in *Psammobius.*

Genotype: Psammobius desertus Van Dyke.

This distinctive little southern California species, which has apparently not been taken since the type, is quite different in facies as well as characters from the other U. S. species of *Psammobius.* From those species that are fully winged it differs especially in the non-sulcate thorax and more robust elongate form, as well as the much less triangular hind tarsal segments; from those U. S. species having very short vestigial wings (as evidenced by the widely rounded elytral humeral angles) the present species differs in the prominent elytral humeral angles as well as in the thorax and leg characters cited above. Also, most of the species of *Psammobius*, including two European species I have studied, have the margin of the hind tibiae serrate, while in the present new genus it is smooth.

Acoma robusta Van Dyke.

This species varies somewhat from the other species of the genus so I have included some line drawings in the accompanying plate to show the general form and salient characters. Apparently quite locally distributed on the Lower California peninsula, as I have seen no specimens except the type series collected by Professor Ferris.

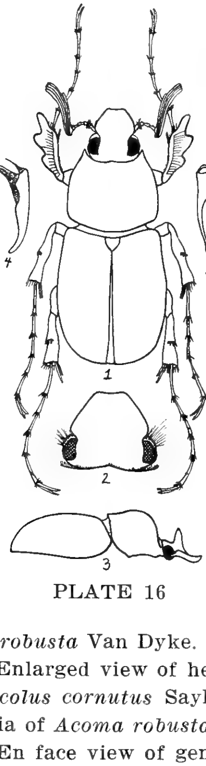


PLATE 16

Figure 1. *Acoma robusta* Van Dyke.
Figure 2. Idem. Enlarged view of head.
Figure 3. *Chaunocolus cornutus* Saylor, from *Type*.
Figure 4. Genitalia of *Acoma robusta* V. D. Side view.
Figure 5. Idem. En face view of genitalia.

BULLETIN of the SOUTHERN CALIFORNIA ACADEMY of SCIENCES

Published by the Academy at Los Angeles, California
Subscription—$2.00 per year

Free to Life Members and Unlimited Annual Members of the Academy (Annual Membership Fee $5.00)

Address all communications to DR. JOHN A. COMSTOCK

Care of Los Angeles Museum, Exposition Park,

Los Angeles, Calif., U. S. A.

Publications of the

Southern California Academy of Sciences

The Academy has published to date the following:

PROCEEDINGS, 1896 to 1899. Six numbers—Vol. 1, Nos. 1 to 6.

MISCELLANEOUS BULLETINS issued under the imprint of the Agricultural Experiment Station, 1897 to 1907. *Ten numbers.*

All issues of the above are now out of print.

■ ■

Bulletin of the

Southern California Academy of Sciences

Began issue with Vol. 1, No. 1, January, 1902. Issued ten numbers in 1902; nine numbers in 1903, 1904, 1905; three numbers in 1906. Issued two numbers annually from 1907 to 1919, both inclusive (except 1908—one issue only). Issued four numbers (January, May, July and October) in 1920.

The 1921 issues are: Vol. XX, No. 1, April; Vol. XX, No. 2, August; Vol. XX, No. 3, December.

The 1922 issues are: Vol. XXI, No. 1, March; Vol. XXI, No. 2, September.

The 1923 issues are: Vol. XXII, No. 1, March; No. 2, July.

The 1924 issues are: Vol. XXIII, No. 1, January-February; No. 2, March-April; No. 3, May-June; No. 4, July-August; No. 5, September-October; No. 6, November-December.

From 1925 to 1936, including volumes XXIV to XXXV, three numbers were published each year. These were issued as No. 1, January-April; No. 2, May-August; No. 3, September-December, for each volume.

PUBLICATIONS OF THE SOUTHERN CALIFORNIA ACADEMY OF SCIENCES

For Sale at the Appended Prices

BULLETIN:

		To Members	To Non-Members
Complete set, Vols. 1 to 33, bound			$100.00
(Incomplete set) Vols. 8 to 33, bound			80.00
Vol. 3, No. 7, 1904		$ .25	.50
" 4, " 5, 1905		.25	.50
" 6, " 1, 1907 (Photostat only)		2.00	4.00
" 6, " 2, 1907		.25	.50
" 7, " 1, 1908		1.00	2.00
" 8, " 1, 1909		1.00	2.00
" 9, " 1, 1910		2.00	4.00
" 9, " 2, 1910		.75	1.50
" 10, " 1, 1911		1.00	2.00
" 10, " 2, 1911		2.00	4.00
" 11, " 2, 1912		1.00	2.00
" 12, " 1, 1913		1.00	2.00
" 15, " 2, 1916		.75	1.50
" 16, " 2, 1917		1.00	2.00
" 17, " 1, 1918		2.00	4.00
" 17, " 2, 1918		1.50	3.00
" 18, " 2, 1919		2.00	4.00
" 19, " 1, 1920		.50	1.00
" 19, " 4, 1920		.50	1.00
" 20, " 1, 1921		2.00	4.00
" 20, " 2, 1921		2.00	4.00
" 20, " 3, 1921		2.00	4.00
" 21, " 1, 1922		2.00	4.00
" 21, " 2, 1922		1.00	2.00
" 22, " 1, 1923		1.50	3.00
" 22, " 2, 1923		2.00	4.00
" 23, " 1, 2, 3, 4, 5, 6, 1924 (each)		.25	.50
" 24, " 1, 2, 3, 1925 (each)		.25	.50
" 25, " 1, 1926		2.00	4.00
" 25, " 2, 3, 1926 (each)		.25	.50
" 26, " 1, 2, 3, 1927 (each)		.25	.50
" 27, " 1, 2, 3, 1928 (each)		.25	.50
" 28, " 1, 2, 3, 1929 (each)		.25	.50
" 29, " 1, 2, 3, 1930 (each)		.25	.50
" 30, " 1, 2, 3, 1931 (each)		.25	.50
" 31, " 1, 2, 3, 1932 (each)		.25	.50
" 32, " 1, 2, 3, 1933 (each)		.25	.50
" 33, " 1, 2, 3, 1934 (each)		.25	.50
" 34, " 1, 2, 3, 1935 (each)		.25	.50
" 35, " 1, 2, 3, 1936 (each)		.25	.50

Miscellaneous, Publications of Affiliated or Co-operating Organizations:

Lorquinia—Vols. 1, 2 (all published) . . . bound $1.50, unbound $1.00

Southern California Geology and Los Angeles Earthquakes, R. T. Hill . . . . . bound 5.00

Southwest Science Bulletin, May 5, 1920 (all published), chiefly Entomological, 1 colored plate 1.00

Check-list of the Recent Bivalve Molluscs (of N. W. Coast of Am. from the Polar Sea to San Diego), W. H. Dall 1.00

(*Continued on next page*)

PUBLICATIONS (*continued*)

Reprints:

Check-list of the Lepidoptera of Boreal America. Superfamilies Sphingoidea, Saturnioidea and Bombycoidea (printed on one side of page only, to allow of additional notes), Wm. Barnes and Foster H. Benjamin, 1927 .... $ .50

The Cacti of the Pyramid Peak Region, Dona Ana County, New Mexico, 1931. F. R. Fosberg .... .25

ADDRESS ALL INQUIRIES TO

SOUTHERN CALIFORNIA ACADEMY OF SCIENCES
(Care DR. JOHN A. COMSTOCK)
Los Angeles Museum, Exposition Park,
Los Angeles, California, U. S. A.

The work of the Southern California Academy of Sciences is carried on entirely through the generosity of private citizens, who are sufficiently interested in the advancement of education and cultural endeavor to donate funds or make bequests to the Academy. As a guide, in the matter of bequests, for those who plan to further this program, the following forms are suggested:

Form of Legacy

To be used when it is desired to leave the Academy any personal property, such as money, stocks, bonds, works of art, or other objects of value.

I give and bequeath unto "Southern California Academy of Sciences," of the City of Los Angeles, the sum of.. Dollars: To have and possess the same unto the said "Southern California Academy of Sciences," its successors and assigns, to the uses, dispositions and benefits thereof forever.

Form of Devise

To be used when it is desired to leave real estate to the Academy.

I give and devise to "Southern California Academy of Sciences" of the City of Los Angeles, (.. here describe the property or ground rent..), together with the appurtenances, in fee simple, and all policies of insurance covering said premises, whether fire, title or otherwise, free from all taxes: To have and to hold the same unto the said "Southern California Academy of Sciences," its successors or assigns forever.

REPRINTS: Contributors of articles accepted for publication in the Bulletin should order reprints, if desired, when they return galley proof to the editor. They may be ordered through the editor at the following rates, from the McBride Printing Co., 261 So. Los Angeles St., Los Angeles, Calif., the contributor paying for all his reprints.

PRICE LIST OF REPRINTS

	4pp.	8pp.	12pp	16pp	20pp	24pp.	28pp.	32pp
50 copies	$3.75	$ 5.75	$ 8.50	$10.25	$11.75	$13 50	$16.00	$17 00
100 "	4.50	7.50	10.75	12.75	15.00	17.25	20.25	21.50
150 "	5.25	9.25	13.00	15.25	18.25	21 00	24.50	26.00
200 "	6.00	11.00	15.25	17.75	21.50	24 75	28.75	30.50
250 "	6.75	12.75	17.50	20.25	24.75	28.50	33 00	35.00
300 "	7.50	14.50	19.75	22.75	28.00	32 25	37.25	39.50

Covers: 50 for $2.00. Additional covers, 1½c each.

California State 3% Sales Tax to be added if delivered within the State.

BULLETIN OF THE

Southern California Academy of Sciences

LOS ANGELES, CALIFORNIA

Vol. XXXVI May-August, 1937 Part 2

CONTENTS

Issued September 30, 193[illegible]

Southern California Academy of Sciences

OFFICERS AND DIRECTORS

Dr. Howard R. Hill - - - - - - - - - - - - - President
Dr. Ford A. Carpenter - - - - - - - First Vice-President
Mr. Theodore Payne - - - - - - - Second Vice-President
Dr. Carl S. Knopf - - - - - - - - - - - - - Secretary
Mr. Harry K. Sargent - - - - - - - - - - - Treasurer

Dr. William A. Bryan
Dr. Ford A. Carpenter
Dr. John A. Comstock
Mr. Samuel Moody Haskins
Dr. Howard R. Hill
Dr. Carl S. Knopf
Mr. Theodore Payne
Mr. Harry K. Sargent
Mr. William A. Spalding
Dr. R. H. Swift
Dr. D. L. Tasker

ADVISORY BOARD

Mr. Fred E. Burlew
Dr. Chester Stock

ASTRONOMICAL SECTION

Mr. Harry K. Sargent
Mr. William A. Spalding

BOTANICAL SECTION

Mr. Theodore Payne, *Secretary*

ARCHEOLOGICAL SECTION

Dr. Carl S. Knopf
Dr. R. H. Swift

FINANCE COMMITTEE

Mr. William A. Spalding
Mr. Samuel Moody Haskins

PROGRAM COMMITTEE

Dr. Howard R. Hill, *Chairman*
Dr. John A. Comstock
Dr. Carl S. Knopf

COMMITTEE ON PUBLICATION

Mr. William A. Spalding, *Chairman*
Dr. John A. Comstock

Office of the Academy
Los Angeles Museum, Exposition Park, Los Angeles, Cal.

ATLATL DART FORESHAFTS FROM THE LA BREA PITS

By Arthur Woodward

During the past fifteen years, the recurring discovery of artifacts in direct association with the remains of extinct mammal forms of the Pleistocene period has convinced all, but the most acute sceptics, of the presence of man on the North American continent several thousand years ago. Now the problem is not whether man was a contemporary of those prehistoric beasts, but rather, how long the various forms of animal life survived. The difficulty at the present time seems to be the rearrangement of the life span of certain of the Pleistocene animals such as the sloth, camel, bison, etc. Paleontologists and geologists must make this adjustment. Archeologists have found enough evidence in Texas, New Mexico, Nebraska, Iowa, Nevada and California[1] to prove that man existed in those regions between 10,000 and 15,000 years ago. Hitherto, the paleontologists and geologists have been responsible for determining the periods in which the Pleistocene fauna existed. The definite entrance of early man upon the scene, now seems to have somewhat altered the situation, and whereas the close of the Pleistocene was formerly set at about 30,000 years, the tendency now is to abandon that date line and advance the life period of certain Pleistocene forms into the Recent period. Hence, although man may not lay a definite claim to an existence upon the North American continent earlier than 15,000 years, his presence here has achieved considerable more antiquity than was previously admitted, and regardless of the ultimate outcome of Pleistocene date discussion, he has, by the undeniable presence of his artifacts, proved himself a contemporary of certain of those animal forms in the states previously mentioned.

One of the greatest deposits of Pleistocene mammal and bird remains, that of the Rancho La Brea in Hancock Park, Los Angeles, California, under the direct control of the Los Angeles Museum, although yielding quantities of such material has supposedly proven barren of artifacts of any decided antiquity.

Excavations by the Museum from July, 1913, to September, 1915, yielded thousands of mammal and bird bones, ancient and recent, in an excellent state of preservation. Man-made artifacts were decidedly in the minority and those that were discovered came from one area known as Pit 61-67, from Pit 10 and one stone arrowhead was found in another pit excavated by the University of California in 1912.

Human skeletal remains, consisting of a skull, apparently that of a small, adult Indian woman and a few fragmentary bones, were found in Pit 10, at depths ranging from 6½ to approximately 9 feet, in February, 1914.

No other artifacts pertaining to man were found in this pit.

A specimen described by Prof. John C. Merriam[2] as an arrowhead was found in "a comparatively recent asphalt deposit encountered in the University of California excavations of 1912."

A series of fifteen artifacts made of bone, stone, shell and wood, all from one general area in what was described as being the bed of an old "pond," in effect an old deposit of asphaltum which had apparently filled in with clay and had acted as a basin to catch and retain rain water. This excavation was known as Pit 61-67 and the objects mentioned were recovered from the asphaltum at depths ranging from 8 to 18 feet.

Aside from a few brief comments made by Dr. Merriam and Dr. Ales Hrdlicka[3] upon the cranium recovered from Pit 10, and the arrowpoint found in the University of California excavation, no study was ever made of the collection of objects pertaining to man, taken from Pit 61-67.

Concerning the skull, Dr. Hrdlicka stated:

"Taking everything into consideration, there is nothing in the La Brea find which would enable the anthropologist to accept the remains as representative of any American earlier than the Indians."

Prof. Merriam gave his views on the subject in the following paragraph:

"The final summing up of all evidence relative to the antiquity of the Rancho La Brea skeleton will depend on a very detailed and exhaustive study of the typical Pleistocene Rancho La Brea fauna from the later tar deposits like that of Pit 10, and of the existing fauna of California. No one of these three factors is as yet satisfactorily known. Until they are all known, the last word on the subject cannot be written."

Thus, while Dr. Hrdlicka considered the skull as being that of an Indian, no great antiquity was attributed to it. Similarly the scattered artifacts recovered from Pit 61-67 while never critically examined, have for a number of years been exhibited in the same case with the skull from Pit 10 and although many students have casually examined the contents of the case, no one ever considered the specimens as other than those pertaining to the more recent Chumash or Gabrielino people who once inhabited the region.

Artifacts from Pit 61-67

In order to avoid confusion it seems best to enumerate all of the specimens found in this pit. The pit number 61-67 indicates that this excavation, although it began as two separate pits, merged into one pit, hence it may be considered as such.

Although all of these specimens have been considered relatively modern, that is to say, the bulk of them correspond to specimens obtained from such sites as Muwu, Simomo, Redondo and inland rock shelters in Los Angeles and Orange counties from which the inhabitants have been absent but a scant one hundred and twenty-five years, recently in making a more critical examination of the collection I was struck by the fact that at least four of the objects were decidedly different from the rest, and unless I am mistaken these latter items may have a respectable antiquity, probably contemporary with the late Pleistocene fauna of the region.

Of the modern specimens there are the following:

- 4 elk antler wedges.
- 2 thin, well-made perforated bone objects, probably pendants or ear ornaments.
- 1 broken bone specimen apparently part of an ornament.
- 1 small pointed deer bone implement. It may be either an awl or the barb of a fish hook or fish harpoon.
- 1 well made deer bone implement with rounded spatulate point.
- 1 white quartz object which may be a crude knife blade.
- 1 fragment of a cogged stone. This specimen consists of half of the stone and was perforated in the center and has deep indentations on the periphery and while different than the usual type, is not unknown in California collections.
- 1 small cardium shell pendant with two perforations.
- 1 spatulate shaped wooden object, use unknown although it may have been a hair ornament.

Unfortunately we have no definite chronological index to the greatest antiquity of any of these particular types. We do know they occur upon many of the late sites well into the historical period, which in southern California we may place after 1542.

What the prototypes of these artifacts were, we cannot say. The use of elk antler for wedges indicates (1) that those animals had a greater range in previous years than is now known,

their present habitat being the San Joaquin Valley or (2) the Indians either obtained those wedges by trade or by going into the San Joaquin after the animals or (3) Indians from the San Joaquin came into the Los Angeles area.

Any one of these three surmises may be correct. Hence there is no reason to suppose these implements might be of too great an age.

However there are four wooden artifacts lying in the same case, all of which apparently came from the same general area in the pit at approximately fifteen feet in depth, which in my estimation do not belong in the same cultural level as those already mentioned.

Three of these I deem to be the broken fragments of *atlatl* dart foreshafts while the fourth, which is practically intact, is readily recognizable as the bunt foreshaft of an *atlatl* dart.

Mr. M. R. Harrington of the Southwest Museum was called in to examine the specimens and came to the same conclusion, namely, that aside from the apparent similarity of the broken fragments to known *atlatl* dart foreshafts, the more complete specimen was a bunt foreshaft for use with an *atlatl* dart.

Since the pointed fragments and the bunt all evidence the same type of workmanship, and typologically are similar, with regard to diameter and weight, the inference is that they were used in the same manner.

Description of the Foreshafts

In plate 17 is shown specimen No. 198, the bunt foreshaft. It is 5 inches in length and has a maximum diameter of 1⅛ inches. It tapers from ¾ to ⅜ of an inch in the shank. A portion of the blunt head is missing, apparently taken away by the sharp edge of an excavating tool. On the opposite side a thin segment is splintered away, seemingly by usage.

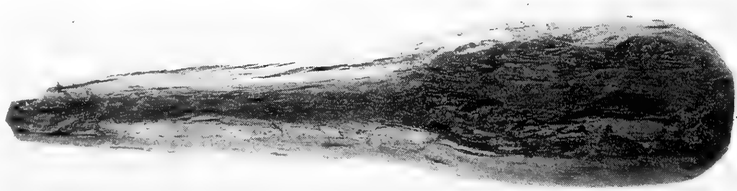


PLATE 17
Bunt foreshaft for atlatl dart. From Pit 61-67, Rancho La Brea. Length 5 inches.

Normally, foreshafts set with stone points are longer than bunt specimens. This is true of specimens Nos. 384 and 385 (see plate 18). The former is 5¼ inches in length, even in its shattered state, and is of the same diameter in the shank as No. 198. Specimen No. 385 is 6¼ inches in length and is of the same diameter as the other two. No. 386 is a charred specimen. It is only 3⅛ inches long and is ½ inch in diameter in its largest part. However, even in this stubby fragment may be seen the same physical characteristics displayed by the other three.

(*a*)

PLATE 18

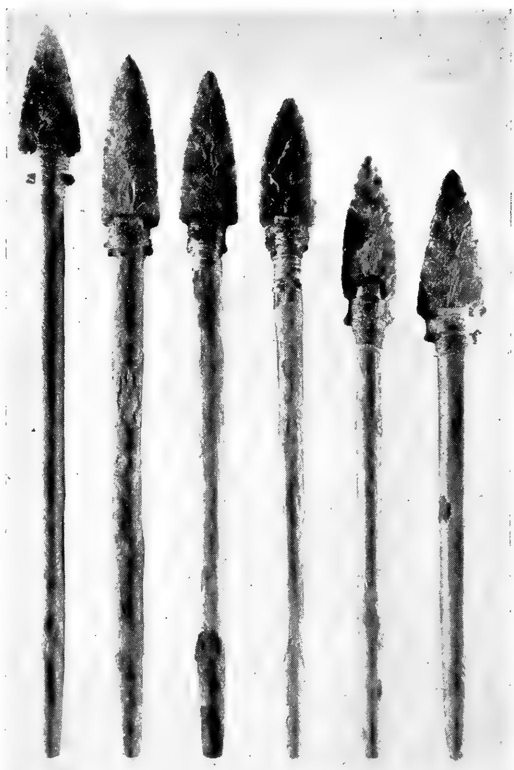
Broken *atlatl* dart foreshafts from Pit 61-67, Rancho La Brea. Length of (*a*) 6¼ inches.

No. 384 was likewise partially fractured by an excavator's mattock but on the opposite side of the broken end the wood is slivered and all evidence points to the fact that this foreshaft was broken by usage.

Every one of the foreshafts is deeply impregnated with asphaltum and weighs more than it normally would.

Specimen No. 385 is broken rather cleanly across the distal end during the course of excavation.

Typologically these specimens are heavier and cruder than those discovered by Mr. M. R. Harrington in Gypsum Cave,[4] Nevada and illustrated in pp. 38 and 50 of his report. Of the two bunt foreshafts featured on page 38, specimen (a) is 3½ inches long. The bunt from Pit 67 is only 1½ inches longer and the shank of the bunt is heavier.



(*a*)

PLATE 19

Six atlatl dart foreshafts from Basket Maker II cave, Cornfield Creek, San Juan Co., Utah. Longest is 10 inches.

Likewise the La Brea foreshafts are heavier than the *atlatl* dart foreshafts found by the Van Bergen - Los Angeles Museum expedition in Basket Maker II caves in San Juan County, southern Utah during the summer of 1930.

The complete foreshafts found in a cache under the floor of a large cave on Cornfield Creek are illustrated in plate 19. The longest (a), including the stone point, is 10 inches, and is ⅜ of an inch in diameter. All six of these foreshafts are in pristine condition and seemingly had never been used when found. They were carefully covered over with a small curved cottonwood slab.

In plate 20 are shown a series of four unfinished foreshafts, taken from an *atlatl* foreshaft-making kit which had been placed with the owner in a small burial cave on Beaver Creek, the northwest slope of Navajo Mountain in southern Utah. Of these, only one, that listed as (b), was ever used. Apparently the point had been broken and removed, but the foreshaft was thrust into the kit with the other three partially finished specimens. It is 8½ inches in length. These four unfinished foreshafts were found, wrapped in a mended piece of fine deerskin pouch and with them were a strip of sinew and a pointed bone tool, near a headless desiccated body.

Comparatively speaking, the foreshafts found in the Basket Maker caves, on Cornfield Creek and Beaver Creek, are of the same types as those described by Pepper, from Grand Gulch, Utah[5] and by Kidder and Guernsey,[6] from Cave I, Kin-Boko Canyon, northeastern Arizona.

One foreshaft mentioned by Pepper, fig. 3 on Pl. II, seems heavier and more like those found in La Brea pit No. 67.

Similarly the Basket Maker foreshafts under discussion approximate in length and diameter the one found in Picacho Cave, southern New Mexico. It is interesting to note that the uniformity of foreshaft diameters makes it possible to interchange those found in San Juan County, Utah, with those from Picacho Cave, although the materials used in the main shafts from those regions are different. Reeds and wood were used in Utah while sotol stalks were the favorite shaft material in southern New Mexico and northwestern Texas.

Basing an estimate of the probable diameter of the shafts originally used with the foreshafts found in Pit 67, upon the diameters of the shafts found in Utah and New Mexico (which averaged ½ to ⅝ of an inch in diameter) and allowing for the increase in diameter necessary to seat the La Brea foreshaft, we might deduce that the main shaft was between ¾ inch and 1 inch in diameter.

(b)

PLATE 20
Unfinished *atlatl* dart foreshafts from burial cave, Beaver Creek, San Juan Co., Utah. Length (b) 8½ inches.

Discussion

While the appearance of *atlatl* foreshafts in the La Brea deposits may not be particularly startling, they are important in that they indicate an *atlatl*-using people once inhabited or at least penetrated into southern California and possibly were contemporaneous with the extinct mammals that once ranged that area.

We have no first-hand knowledge that any of the later California tribesmen ever used the *atlatl* (the specimen said to have been obtained by Capt. Vancouver on the coast of southern California about 1792 will be discussed further on), yet the specimens found in Pit 61-67 indicate that this weapon must have been in vogue in some part of Southern California possibly in the days when the sloth, camel, giant bison, etc., were likewise present.

The very character of the stone, shell and bone specimens attributed to the historic tribes is such that any or all of the implements and ornaments found could have been lost by one person at the same time.

The fact that no great amount of mammal bones of the recent species were recovered from Pit 61-67 seems to indicate that this pit was not actively flowing during the more recent periods yet, paradoxically, or so it would seem, we find artifacts of the historic tribesmen in this very pit.

However, when it is considered that the Chumash and their neighbors frequently resorted to the major bitumen deposits and springs to obtain the viscous mineral for various purposes, a small opening into a pit, from which the *brea* might be obtained, surrounded on all sides by a heavy crust of earth and grass, would be more likely to attract the native tar gatherer than an active pool.

Hence the possibility of a workman losing a pouch containing the assortment of ornaments and tools while collecting tar is not at all an improbability.

On the other hand, judging by the evidence of the broken dart foreshafts and the presence of the Pleistocene fauna and the activity of the pit in Pleistocene times whereby the larger mammals were trapped, it is also easy to conjecture the manner in which the ancient weapons became imbedded in the pit.

One theory concerning the presence of so many Pleistocene animals in the pits is that at certain seasons of the year these depressions were filled with water and the beasts coming to drink were trapped.

Thus it may be that ancient man came to the pit to lance his prey. It is also possible that the dart shafts may have been launched at the animal or animals in some other locality and the hunter failed to down his game and the broken foreshafts were

thus carried into the pit with the wounded beast. However, the bunt foreshaft would indicate that it had been hurled at an animal or bird caught in the pit or on the margin of the pit since that type of a blunt point would be used only for stunning birds or small game and would not become imbedded in the flesh.

The recent discoveries by Mr. and Mrs. William H. Campbell of the Desert Branch of the Southwest Museum at Twenty Nine Palms, in the Pinto Basin, a desert drainage basin in the north-central part of Riverside County, and in the vicinity of the ancient Lake Mohave, have tended to confirm the presence of a well-established occupation of those aseas, under more favorable climatic conditions, from 10,000 to 13,000 years ago by a people who, judging by the artifacts found on the ancient camp sites, were presumably an *atlatl*-using race.[7]

It is unfortunate that we have no horizontal or vertical stratigraphy in the La Brea pits. The action of gases upon the mass of bones, bitumen and earth during the centuries has brought about a slow but steady mixing of the deposit, hence the artifacts were found at varying depths and not in one stratum.

The question now arises as to the possibility of finding surface sites of the same approximate period as that represented by the mammal bones and the early artifacts of Pits 61 and 67. Hitherto all the sites found in the coastal area of southern California have been relatively recent with the possible exception of those noted by Rogers[8] on the San Dieguito plateau. In the main, archeological research in southern California has been largely confined to an examination of historic sites or those occupied by the immediate ancestors of the various tribal groups known to archeologists and ethnologists. To Mr. and Mrs. Campbell and Mr. Malcolm Rogers must go the credit for the pioneer work on ancient man in southern California. However, as it has been pointed out, their work has been conducted largely in the desert areas of the hinterland and now remains the task of making a concentrated search for the equivalent of the desert sites in the coastal plains and western slopes of the coastal range. Such work will require the combined efforts of geologists, paleontologists and archeologists.

After examining the dart foreshafts and noting their condition, one cannot help but wonder how many other artifacts of this type might have been discarded or broken in the course of excavation.

The task of working in the pits was made exceedingly difficult by the constant seepage of water and tar and the caving in of the sides of the pits. Hence it is not surprising that some of the smaller objects such as stone points or bits of broken wood might be overlooked when mucking out the debris. For example, quoting from the field notes of L. E. Wyman on Pit 61-67 for February 15, 1915:

"South wall below 12 feet is crowding in considerably while timbering generally is working out of shape and will have to be straightened. What was level floor yesterday between this pit and No. 61, at 8 feet, has risen 6 inches or more at south end (in H and I-6 and 7) where great body of plastic muck, filling large portion of old pond bed, is working forward and squeezing everything before it."

Again on March 1, in the same pit:

"With continued movement of muck its plasticity increases—as a piece of putty softens when working. Tarry mud is oozing up everywhere through cracks caused by settling and 'creeping.' Evidently there is a great deal of this material beneath and incorporated into the dump itself, and the whole mass so kneaded from constant working that the central portion of the pit to south bank of pond, will have to be removed entirely. . . ."

In fact, one of the bone artifacts from Pit 67 found on May 26, 1915, came from the "muck" which had accumulated under foot and had "apparently suffered by a pick blow or by being trampled by the feet of the men." (Field Notes, Rancho La Brea, Part Two, covering Pits 50 to 96 inclusive, by L. E. Wyman) now in archives of the Los Angeles Museum.

There is also the chance that other human artifacts may have been thrown out of Pit 61-67 at an earlier period, for it was in this pit that old asphaltum mining operations were conducted by the citizens of Los Angeles during the middle of the 19th century, both before and after the development of the petroleum industry (see Field Notes, Pit No. 67, October 28,1914: "Original surface was long ago removed to a depth of nearly 8 feet below Pit No. 4 datum, in mining asphaltum and this depression filled for some distance from the bank with muck from Pit No. 4" et seq.). In 1864-1865 and even a few years earlier American inhabitants of Los Angeles dug into the brea deposits west of town. Judge Dryden, before the petroleum craze struck the Pacific Coast, sunk one shaft 186 feet deep in search of coal in the asphaltum deposits. The "miners" removed some five or six barrels of soft brea from this mine every morning. The bottom of the shaft "hog backed" up to the height of about 3 feet every night. The brea in this mine finally became so annoying that the project was given up. After it was abandoned and the shaft was filled, townspeople went there to dig the soft brea to mix with lumps of hard brea they used to cover their roofs. (See *Evening Bulletin,* San Francisco, March 29, 1865.)

Prior to even this period the Spanish-Mexican element had gathered brea from these pits for roofing purposes, and as already indicated, the prehistoric Indians likewise frequented the brea springs to obtain the tar.

I have cited these instances to indicate that while there was a paucity of artifacts in these pits, there is no means of telling how many may have been thrown out in times past, and owing to the difficulty of working the mixture of soft and hard brea, wind-blown and water-laid dirt, clay and other debris, one need not wonder that small objects were overlooked or broken in the course of excavation.

Modern Use of Atlatls

Whereas, at present, we have no ethnological or archeological data from either tribes living within the present boundaries of the state of California, nor, as far as I am aware, from historic accounts or archeological discoveries in either village sites, burials or shelter cave deposits in southern California, other than the discoveries made by Mr. and Mrs. Campbell in the desert areas, of the primitive use of the *atlatl* in this region.

In a previous paragraph I mentioned an *atlatl* taken to England by Captain Vancouver, the English explorer which is catalogued as having been obtained in the Santa Barbara channel, site undesignated, about 1792-1793.

This is our only record of any *atlatl* within recent times, having been found in California.

Granting the specimen to have been obtained on the southern coast of California, there are yet a number of things to be explained in connection with that specimen.

A full scale replica of this chunky throwing stick was made for the Los Angeles Museum by Mr. Eugene Robinson of Los Angeles. A photograph of this reproduction is depicted in plate 21, fig. A.

Other specimens obtained at the same time, including a paddle used by the Channel dwellers in maneuvering their laced plank-canoes, a hair ornament and a fish harpoon (which is described more at length in another paragraph) all seem to pertain to the material culture of the Channel Islands or the adjacent mainland, hence there seems little reason to doubt the statement that the *atlatl* was likewise obtained in that region.

If the *atlatl* was in use among the Chumash Indians of the coastal area during the 18th century, or in the 16th century, it seems rather peculiar that the Spanish explorers who usually

noted everything else in connection with the country and its people did not mention such a weapon, which by its very oddity would have attracted them. Nor were the Spaniards of the 16th century unacquainted with the weapon. The followers of Cortes in 1519-1521 were attacked by the Aztecs who used the *atlatl* with deadly effect. Hence the utter absence of the *atlatl* in late archeological sites or mention by the early Spanish explorers in California are unsolved mysteries.

A description of this spear-thrower, with a line drawing to scale, was made by Mr. Charles H. Read.[9] His observations are as follows:

"Fig. 1—Spear-thrower of moderately hard, light-colored wood, pierced with two holes for the first two fingers: the hook is made of a piece of bone, rudely shaped. The whole seems to have been once covered with red colour, now almost worn away. From the bone hook to the projection at the broad end of the implement is a shallow channel, as usually found. This would seem to be the 'Santa Barbara throwing stick,' of the M. S. catalogue; both from its similarity in work to the other Santa Barbara specimens, and from the fact that the other throwing sticks in the collection correspond with their respective numbers in the catalogue. This variety is unknown to me from any other source, and it does not occur in Mr. O. T. Mason's 'Throwing Sticks in the (United States) National Museum,' Washington, 1890."

As noted by Mr. Read, this odd, stubby throwing stick is decidedly different from spear throwers in other parts of North and South America.

The only *atlatl* which is at all comparable, and in such an instance the resemblance is confined to the hand grip alone, is that used by the Tarasco Indians on Lake Patzcuaro in Mexico. Lumholtz[10] illustrates one of these sticks in his work on Mexico and a full scale replica of this implement, likewise made by Mr. Robinson, is shown in plate 21, fig. B.

The replica of the Santa Barbara *atlatl* collected by Vancouver is 6 inches in length and 1 inch thick.

At best, when compared to the other known examples of *atlatls* from all parts of the globe, the California specimen seems a poor and inefficient weapon. In effect, it could not have served as much more than a base upon which to rest the butt end of a heavy spear; certainly the leverage gained by the length of the throwing stick could not have given the user any too great an advantage.

(*a*)

(*b*)

PLATE 21

(*b*) Full size replica of Tarascan *atlatl*. Length 23⅝ inches.

(*a*) Full size replica of *atlatl* obtained by Capt. Vancouver in southern California, 1792. Length 6 inches.

Another specimen collected by Vancouver from some place along the Santa Barbara channel which may be more pertinent in depicting the type of harpoon used by the later tribesmen of that region, is the fore-shafted "fish spear," a full scale replica of which is shown in plate 22.

This weapon consists of a foreshaft 12 inches long, set with a chert blade and a bone barb. Both point and barb are fastened to the foreshaft by means of bitumen and a lashing of fibre cord.

It will be noted that the shape of the butt end of this foreshaft differs decidedly from the types found in La Brea pit. As Read suggests, the base of the harpoon foreshaft was probably "originally attached to the shaft by a line," the small shoulder at the butt of the foreshaft serving as a means of keeping the line fastened securely to it. The true *atlatl* foreshafts to my knowledge never show this shoulder.

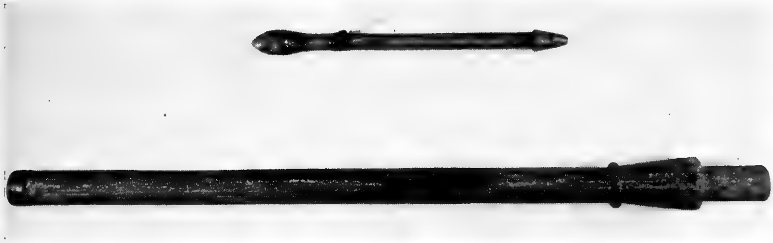


PLATE 22
Full scale replica of foreshafted harpoon obtained by Capt. Vancouver in southern California in 1792. Length of shaft 27½ inches.

The main shaft of this harpoon is heavy, and in its diameter at least resembles those used by the Eskimo. The length of the shaft is 25 inches, but a portion of the butt end has been destroyed by termites, hence we do not know the exact length of the lance. The diameter of the shaft is 1¼ inches, which would seem to relegate this particular harpoon to the category of hand thrusting weapons, thus eliminating it as a type spear to be used in conjunction with the short spear thrower, unless, as I have suggested previously, the Santa Barbara spear-thrower was used more as a lance rest for downright thrusting than an overhand or side casting projectile aid.

Aside from these specimens collected by the great English explorer in the late 18th century, I am unaware of any other similar objects in existence. I have cited these examples to indicate the possibility that at that time, there may have been a cultural memory, expressed in the rather poor specimen, of the use of spear-throwers in southern California. If such is the case, then the La Brea specimens may well be the legitimate ancestors of a type of *atlatl* dart once in vogue in that area, and the presence of the *atlatl* either on the Channel Islands or the adjacent mainland in the 18th century does not necessarily mitigate against the assumption of age in regard to the specimens from Rancho La Brea.

Although the *atlatl* is considered one of the most ancient weapons on the continents of North and South America and one antedating the use of the bow and the arrow, the fact that it has continued in daily use as a contemporary of the modern high-power rifle indicates a decided cultural lag in favor of the implement, which by all rights should have passed out of existence with the prehistoric fauna.

At the present time the *atlatl* is in use in at least two places in Mexico, on Lake Patzcuaro and in the little fishing village of San Felipe on the eastern shore of Baja California. In the latter place according to observations made by Mr. Fred Dato of Calexico, California, these throwing sticks are a very simple affair, consisting of a straight stick about 3 feet long, having no finger grips, not even a cross bar which the crudest *atlatls* usually had, although certain of the Aztec spear-throwers were without such hand grips.[11] A sketch of the *atlatl* described by Dato and one with a simple peg finger grip, found by M. R. Harrington[12] in Allred Bluff rockshelter, Benton County, Arkansas, 1922-1923, are shown in plate 23. Other varieties of the more simple *atlatls* are shown by Saville, pls. VI and XIX.[13]

A light shaft about 4 or 5 feet long is used with the San Felipe type thrower; the butt end of the shaft rests in a female socket rather than against a bone or wooden peg. See fig. (*a*), plate 23.

(*a*)

(*b*)

PLATE 23

(*a*) Type of *atlatl* used by Yaqui Indians.

(*b*) Type of *atlatl* found in bluff shelter, Benton Co., Arkansas.
(Not drawn to scale.)

Dato likewise informed me that as a boy, living on the Yaqui River among the Yaqui Indians over forty years ago, he saw this same type *atlatl* in use among those people. It was used by the young men and boys in hunting rabbits. It so happens that part of the population in San Felipe are Yaqui Indians, or so I was informed by Dato, who seemed thoroughly conversant with all parts of the eastern coastal area of Baja California and the states of Sonora and Sinaloa. Hence the presence of the *atlatl* in Baja California may be readily explained and its antiquity in that part of the country need not be considered too

seriously, at least not until more definite evidence is produced of its previous use by the prehistoric inhabitants of the region. The use of the throwing stick in San Felipe is confined largely to the adolescent boys who hurl light shafts with an overhead cast at sea birds floating off shore.

The use of the *atlatl* was discontinued by the Point Barrow Eskimo twenty-five years ago, according to information furnished to me by Mr. Charles Brower of Point Barrow, an American who has made his home at that isolated point since the 1880's.

Thus it is that the *atlatl,* one of our most ancient weapons, has continued to survive and the presence of the eighteenth century form found by Vancouver in southern California may well have been the last vestigial remnant of the weapon once used by the inhabitants of the southern part of the state several thousand years ago.

Bibliography

1. The following items include some of the best contemporary publications upon the antiquity of man in North America. However, it must be understood the list is by no means complete and each day finds new papers being issued by archeologists and paleontologists throughout the United States.

Antevs, Ernst

The occurrence of flints and extinct animals in pluvial deposits near Clovis, New Mexico, pt. 2, Age of the Clovis Lake clays. Proc. Acad. Nat. Sci., Philadelphia, vol. 77, pp. 304-312, Oct. 10, 1935.

Cook, H. J.

New geological and paleontological evidence bearing on the antiquity of mankind. Nat. Hist. Journ., Amer. Mus., Nat. Hist., vol. 27, no. 3, pp. 240-247, May, 1927.

Campbell, E. W. C., and W. H.

The Pinto Basin site. Southwest Mus. Pap., no. 9, 1935.

Figgins, J. D.

The antiquity of man in America. Nat. Hist. Journ., Amer. Mus. Nat. Hist., vol. 27, no. 3, pp. 229-239, May-June, 1927.

An additional discovery of the association of a "Folsom" artifact and fossil mammal remains. Proc. Colo. Mus. Nat. Hist., vol. X, no. 4, Sept. 26, 1931.

Folsom and Yuma artifacts. Proc. Colo. Mus. Nat. Hist., vol. 13, no. 2, Dec. 29, 1934.

Folsom and Yuma artifacts, pt. 2. Proc. Colo. Mus. Nat. Hist., vol. 14, no. 2, Oct. 3, 1935.

A further contribution to the antiquity of man in America. Proc. Colo. Mus. Nat. Hist., vol. 12, no. 2, Aug. 1, 1933.

Harrington, M. R.

Gypsum Cave, Nevada. Southwest Mus. Pap. no. 8, Los Angeles, 1933.

A stratified camp-site near Boulder Dam. The Masterkey, vol. XI, no. 3, May, 1937.

Hay, O. P., and Cook, H. J.

Fossil vertebrates collected near, or in association with human artifacts at localities near Colorado, Texas; Frederick, Oklahoma, and Folsom, New Mexico. Proc. Colo. Mus. Nat. Hist., vol. 9, no. 2, Oct. 20, 1930.

Howard, E. B.

Evidence of early man in North America. Mus. Journ., vol. 24, nos. 2-3, Univ. Pennsylvania Mus., 1935.

Association of artifacts with mammoth and bison in eastern New Mexico. Science, n. s., vol. 78, p. 524, Dec. 8, 1933.

Grooved spearpoints. The Pennsylvania Archeologist, Bull. Soc. Pennsylvania Archeol., vol. 3, no. 6, Jan., 1934.

Jenks, A. E.

The discovery of an ancient Minnesota maker of Yuma and Folsom flints. Science, n. s., vol. 80, p. 205, Aug., 1934.

Recent discoveries in Minnesota prehistory. Minnesota History, Quarterly Magazine, vol. 16, no. 1, pp. 1-21, Mar., 1935.

Renaud, E. B.

Prehistoric flaked points from Colorado and neighboring districts. Proc. Colo. Mus. Nat. Hist., vol. 10, no. 2, Mar. 31, 1931.

Archeological survey of eastern Colorado. Univ. of Denver, Dept. Anthrop., June, 1931.

Archeological survey of eastern Colorado (second report). Univ. of Denver, Anthrop., March, 1932.

Yuma and Folsom artifacts (new material). Proc. Colorado Mus. Nat. Hist., vol. 11, no. 2, Nov. 19, 1932.

Archeological survey of eastern Colorado (third report), season 1932. Univ. Denver, Dept. Anthrop., Mar., 1933.

Archeological survey of western Nebraska, summer 1933. Univ. Denver, Dept. Anthrop., May, 1934.

The first thousand Yuma-Folsom artifacts. Univ. Denver, Dept. Anthrop., Oct., 1934.

Roberts, F. H. H., Jr.

A Folsom complex, preliminary report on investigations at the Lindenmeier site in northern Colorado. Smithsonian Misc. Coll., vol. 94, no. 4, Washington, D. C., June 20, 1935.

Additional information on the Folsom complex; report on the second season's investigations at the Lindenmeier site in northern Colorado. Smithsonian Misc. Coll., vol. 95, no. 10, Washington, D. C., June 20, 1936.

See also brief mention of Roberts' visit to site near Anderson, Iowa, Fifty-third Annual Rept., Bureau of American Ethnology, 1935-1936, Washington, D. C., 1937.

Schultz, C. B.

Association of artifacts and extinct mammals in Nebraska. Bull. 33, Nebraska State Mus., vol. 1, Nov., 1932.

Woodward, Sir Arthur Smith

Recent progress in the study of early man. Science, vol. 82, no. 2,131, pp. 399-407, Nov. 1, 1935.

2. Merriam, Prof. John C.

Preliminary report on the discovery of human remains in an

asphalt deposit at Rancho La Brea. Science, n. s., vol. XL, pp. 198-203, New York, Aug. 7, 1914.

3. Hrdlicka, Dr. Ales
   Recent discoveries attributed to early man in America. Bulletin 66, B. A. E., Washington, D. C., 1918.

4. Harrington, M. R.
   Gypsum Cave. Southwest Mus. Pap., no. 8, pp. 38-50, Los Angeles, 1933.

5. Pepper, G. H.
   The throwing-stick of a prehistoric people of the Southwest. Proc. Int'l. Cong. Americanists, 13th session, N. Y., 1902, pp. 107-133, New York 1905.

6. Kidder, A. V., and Guernsey, S. J.
   Archeological explorations in northeastern Arizona. Bull. 65, B. A. E., pp. 178-182, Washington, D. C., 1919.

7. Campbell, E. W. C., and Wm. H.
   The Pinto Basin site. Southwest Mus. Pap., no. 9, Los Angeles, Mar., 1935.
   Southwest Museum Papers, No. 11. The archeology of Pleistocene Lake Mohave—a symposium by Elizabeth Crozer Campbell, William H. Campbell, Ernst Antevs, Charles A. Amsden, Joseph A. Barbieri and Francis G. Bode. Los Angeles, 1937.

8. Rogers, Malcom J.
   The stone art of the San Dieguito plateau. American Anthropologist, n. s., 31, pp. 454-467, Menasha, Wis.

9. Read, Charles H.
   An account of a collection of ethnographical specimens formed during Vancouver's voyage in the Pacific Ocean, 1790-1795. Journ. Anthrop., Inst. of Great Britain and Ireland, vol. XXI, p. 106, pl. XI.

10. Lumholtz, Carl
   Unknown Mexico, v. II, p. 449, New York, 1902.

11. Saville, Marshall H.
   The woodcarver's art in ancient Mexico. pp. 36-54, New York, 1925.

12. Harrington, M. R.
   The Ozark bluff-dwellers. American Anthropologist, n. s., vol. 26, no. 1, Pl. III-b, Jan.-Mar., 1924.

13. Saville, M. H.
Ibid.

Additional information on *atlatls* may be found in the following references not previously mentioned:

Krause, F.
Sling contrivances for projectile weapons. Smithsonian Report for 1904, Washington, 1905. (This is a condensed translation of Schleudervorrichtungen fur Wurfwaffen, Internationales fur Ethnographie Leiden, band, XV, Heft IV, 1902.)

Mason, Otis T.
Throwing sticks in the National Museum, Smithsonian Report 1884, pt. 2.

Nuttall, Zelia
The *atlatl* or spear-thrower used by the ancient Mexicans. Archeological and Ethnological Papers, Peabody Museum, vol. 1, no. 3, Cambridge, Mass., 1891.

Starr, Frederick
Some North American spear-throwers. Inter. Archiv fur Ethnog., vol. XI, pp. 233-235.

PLATE 24
Triphora fossilis Willett.
Type, enlarged x 3½.

ADDITIONS TO KNOWLEDGE OF THE FOSSIL INVERTEBRATE FAUNA OF CALIFORNIA

By G. Willett

During the spring and summer of 1937 considerable work was done by John Q. and Tom Burch, Mrs. Effie M. Clark, and the writer on an exposure of the Timms Point horizon at San Pedro, California. Several thousand specimens, mostly mollusks, have been recovered and classified, with the result that numerous facts new to our knowledge of Californian fossils have been brought to light. Although the exposure worked must be quite near the ones reported on by Dr. Alex Clark (Trans. S. Diego Soc. Nat. Hist., vol. 7, no. 4, 1931, pp. 25-42), a comparison of his faunal list with ours shows numerous differences between the two. This, of course, is not surprising, as such variation is frequent in our present day fauna, even in nearby localities.

Whether the lower portion of the Timms Point exposure (where our work was done) is Pliocene, as considered by Dr. Ralph Arnold (Mem. Calif. Acad. Sci., vol. 3, 1903), or lower Pleistocene, as Dr. Clark believed, is not discussed here, the purpose of this paper being only to record occurrences that add to our list of fossils, or to extend known ranges of species. Although more than two hundred species of mollusks from this locality are in our collections, only those believed to be of special interest are listed in the following notes.

Pseudochama granti Strong. Numerous specimens taken are identical with topotypes of *granti* from Catalina Island. Whether this is anything more than the young of *P. exogyra* (Conr.) is still a question.

Macoma carlottensis Whiteaves + *M. inflatula* Dall. *Macoma planiuscula* Grant and Gale. These two species, neither of which appears to have been recorded as fossil from California, are both rather common in our material. I have followed Grant and Gale (Mem. S. Diego Soc. Nat. Hist., 1, 1931, p. 372) in considering *M. inflatula* Dall a synonym of *M. carlottensis* Whiteaves.

Panomya turgida Dall. A study of Alaskan specimens of *Panomya* in the writer's collection appears to indicate that there has been a rather general confusion of this species with *P. ampla* Dall. Dr. Dall's illustration of *ampla* (Proc. U. S. Nat. Mus., 24, 1902, pl. 40, figs. 3, 4) certainly does not represent the same shell that Oldroyd (Stanford Univ. Publ. Geol., 1, 1924, pl. 10, fig. 3), and Grant and Gale (op. cit, pl. 21, figs. 10a, 10b) figure as that species. I have not seen the specimens upon which the

records of *ampla* from Deadmans Island (Arnold, op. cit., p. 183), and Timms Point (Clark, op. cit., p. 30) were based. However, examples secured in the latter locality by Mrs. E. M. Clark and John Q. and Tom Burch are not *ampla,* but nearer to, if not identical with, *turgida,* as figured by Dall (U. S. Nat. Mus. Bull., 112, 1921, pl. 2, fig. 1). *Ampla* is very irregular in outline, being broadly truncated at one end and rather pointed at the other, while *turgida* is much more equilateral.

Dentalium rectius Carpenter. Although this species does not appear to have been recorded as a fossil from California, a number of specimens are in our collections.

Lora reticulata (Brown). Numerous specimens taken together with *L. fidicula* (Gould).

Trivia ritteri Raymond. One specimen in the Burch collection. Previously recorded from upper Pliocene at Fifth and Hope streets, Los Angeles, California (Grant and Gale, op. cit., p. 754).

Triphora fossilis, new species. Plate 24. Description: Shell sinistral, elongate-conic, brown. Nuclear whorls decollated. Later turns ornamented by two subequal ridges (one at the summit and the other just above the periphery), which are truncated posteriorly and gently rounded anteriorly. On the eleventh turn a slender cord appears between the two ridges, somewhat nearer the posterior one, and continues to the body whorl, where it is slightly increased in size. The whorls are also marked by axial ribs, weaker than the main spiral ridges, the intersections of the ribs and spirals forming strong tubercles. There are about 16 tubercles on the early whorls and about 22 on the last two. Sutures moderate, showing little trace of peripheral keel, even on the penultimate whorl. Periphery of last turn marked by keel which is crossed by the axial ribs. Base decorated by two slightly rounded spiral cords, the first of which is just below the peripheral keel and the second on the columella. Aperture (somewhat broken) oval, strongly channeled anteriorly.

The type, No. 1053 Los Angeles Museum, has 14 whorls and measures 8.3 by 2.1 millimeters. The type, together with another specimen, was collected by G. Willett in the lower part of the Timms Point formation, San Pedro, California, summer of 1937. There is also a specimen in the collection of Mrs. E. M. Clark.

This species differs from *Triphora carpenteri* Bartsch in less strongly channeled sutures and in the very weak median cord, which only appears on the later whorls. It is larger than *T. hemphilli* Bartsch, and the median cord appears much later than in that species. A few specimens of *T. pedroana* Bartsch were taken in the same deposit.

Barleeia oldroydi Bartsch. Twenty-five specimens taken by the writer.

Natica russa Gould. As Grant and Gale have pointed out (op. cit., p. 798), this species has frequently been confused with *N. clausa* Broderip and Sowerby. All the *Naticas* found by us at Timms Point (20 in Los Angeles Museum) are referable to *russa* rather than *clausa*. Not only do they have the larger callus plug of the former, but they still show much of the brown coloration. *N. clausa* is much lighter in color, varying from cream to olive. This is the first definite fossil record for *russa* in California, but many records of *clausa* probably belong here.

Velutina laevigata (Linnaeus). One specimen collected by the writer.

Acmaea funiculata Carpenter. Although I have not seen Recent specimens showing intergradation between this species and *A. mitra* Eschscholtz, there appear to be such among our fossils. Of six specimens from Timms Point in the Los Angeles Museum, one is typical *mitra*, two are *funiculata*, and the other three are intermediates.

Leptothyra subobsoleta, new species. Plate 25. Description: Shell small, globose, imperforate; about three and one-half rounded whorls, a more or less obscure keel running around the base from the insertion of the outer lip. Under a lens there are very faintly indicated spiral striations. Aperture (more than half the length of the shell) rounded-oval with vertical axis slightly longer than horizontal one. Columella grooved anteriorly, not denticulate; columellar callus barely covering umbilicus. Color of shell light brown (probably darker in life) with an irregular lighter area around the closed umbilicus.

The type, No. 1054 Los Angeles Museum, measures: alt., 3; diam., 2.8 millimeters. Paratypes in Burch and Clark collections. The type and 30 additional specimens were taken by G. Willett in the lower Timms Point formation, San Pedro, California, summer of 1937.

This species differs from *L. bacula* Carpenter in much smaller size, smoother whorls, and lack of columellar teeth. It appears nearest to *L. engbergi* Willett (Nautilus, 43, 1929, p. 27), from Olga, Washington, but differs from that species in much fainter striations, less rounded (slightly carinated) body whorl, and in light colored zone around umbilical region.

Solariella varicosa Mighels and Adams. Five specimens taken by the writer appear referable to this species, though, judging from their small size, none is adult.

Vitrinella stearnsi Bartsch. One specimen in the Burch collection.

Puncturella cooperi Dall. It is strange that neither Arnold nor Clark have recorded this species from the San Pedro deposits, as it was found to be abundant in the lower part of the section we worked. Several hundred specimens are preserved in the Los Angeles Museum and others in the Burch and Mrs. E. M. Clark collections. *P. cucullata* (Gould) was considerably less plentiful, and only three specimens of *P. galeata* (Gould) were found.

Puncturella delosi Arnold. Three specimens of this species, previously known only from the Santa Barbara Pliocene, were secured by the writer. Dr. Dall's unfigured Recent species, *P. carophylla* (Nautilus, 28, 1914, p. 63), should be compared with this.

Epitonium catalinae Dall. *Epitonium sawinae* Dall. A few specimens of each of these two *Epitoniums* were found.

Ischnochiton trifidus Carpenter. One tail valve in Burch collection.

Mopalia imporcata Carpenter. Three head valves and two median valvevs in Museum collection.

PLATE 25
Leptothyra subobsoleta Willett.
Type, enlarged x 3½.

A NEW SPECIES OF AZENIA FROM CALIFORNIA (NOCTUIDAE; ACRONICTINAE)

By J. F. Gates Clarke

Bureau of Entomology and Plant Quarantine,
U. S. Department of Agriculture

The following new species, for which a name has been requested, was received from Dr. J. A. Comstock of the Los Angeles Museum.

Azenia templetonae, New Species

Antenna clay colored; basal segments with whitish-cream colored scales intermixed. Labial palpus dark clay color with whitish-cream scales intermixed. Head, thorax, and forewing whitish-cream, the forewing heavily overlaid with clay color, so much so that it appears cinnamon-buff. Head, thorax, and tegulae with a considerable number of clay-colored scales. Forewing without markings except a very faint, narrow, dark-colored transverse posterior line; cilia whitish-cream distally and clay-colored basally. Hind wing whitish-cream overlaid with light clay-colored scales, especially outwardly, with a faint purplish cast; cilia whitish-cream distally, clay-colored basally.

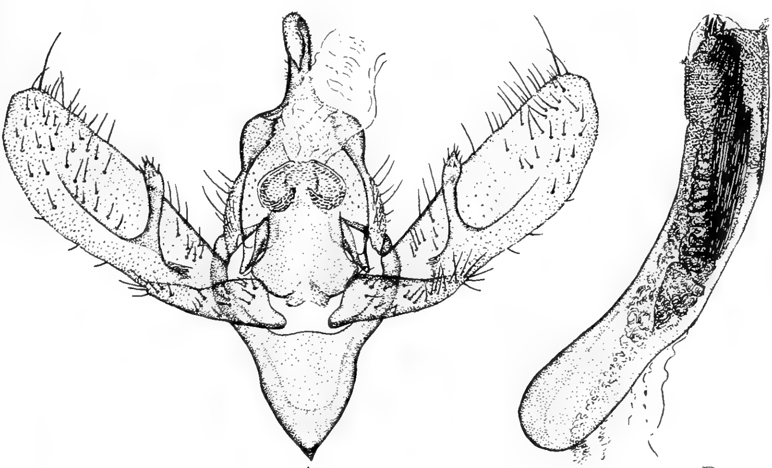


PLATE 26
Male genitalia of *Azenia templetonae* Clarke.
Drawing by Mrs. Eleanor A. Carlin.

Legs whitish heavily overlaid with brown, especially exteriorly; annulations of tarsi cream-colored. Abdomen light clay color.

Male genitalia: Harpes symmetrical, moderately clothed with hairs; sacculus broadly folded, moderately sclerotized; clasper long, slender, exceeding costa, slightly excurved and dilated distally. Anellus a broad lightly sclerotized plate, expanded basally; sides subparallel. Transtilla consisting of two curved, elongate plates with heavy membranes attached; the latter forming a hood over the aedoeagus. Aedoeagus long, stout, slightly bent; vesica armed with many long cornuti. Vinculum broad, abruptly narrowed anteriorly, terminating in a sharp point. Uncus very long, curved.

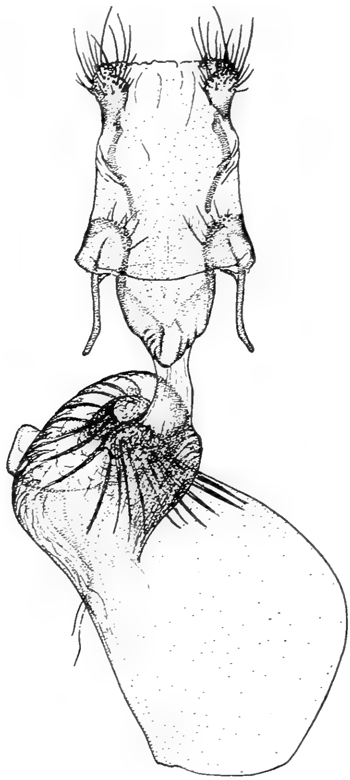


PLATE 27

Female genitalia of *Azenia templetonae* Clarke.

Drawing by Mrs. Eleanor A. Carlin.

Female genitalia: Ostium broad. Ductus bursae short, membranous except for the broad, triangular, sclerotized part before the ostium. At the point of contact between the bursa copulatrix and the ductus bursae there is a small, strongly sclerotized area from which radiate slender, sclerotized rods. Dorsally there is a narrow, twisted extension of the bursa from which the ductus seminalis emerges.

Alar expanse: 23-25 mm.

Type: U. S. National Museum No. 52040.

Type locality: Emigrant Springs, So. California (6-IV-35, Willett.)

In addition to the type male, there are one male and two female paratypes from Furnace Creek, Death Valley, California (7-IV-35, Bonnie Templeton).

One male paratype is deposited in the Canadian National Collection and a female paratype is deposited in the Los Angeles Museum.

This species may be easily distinguished from the only other recognized species of this genus (*A. implora* Grt.) by the longer clasper and broader harpes of the male and by the presence of the radiating sclerotized rods of the bursa of the female (absent in *implora*).

I am pleased to name this species in honor of Miss Bonnie Templeton who collected three of the four specimens of the type series.

The drawings of the genitalia were made by Mrs. Eleanor A. Carlin, staff artist of the Bureau of Entomology and Plant Quarantine.

NOTES ON THE EARLY STAGES OF THREE CALIFORNIA MOTHS

By John A. Comstock and Charles M. Dammers

Hemileuca burnsi Watson.

This species was first described by J. Henry Watson in the Annual Report and Transactions of the Manchester Entomological Society, 1910, pp. 30-34, from material sent by Mr. Fred Burns.

The type series were taken in the "neighborhood of Truckee Pass, Nevada."

A colored plate accompanies the description, on which are shown six examples of the moth, a small cluster of eggs, and a poor figure of the pupa.

Figure I of this plate depicts a male in which the secondaries are immaculate except for the black discal spot. Watson evidently considered this the normal form of the male, since he shows on figure 2 of the same plate a second male, which he designates "ab. *ilmae*," in which the submarginal black bands occur on the secondaries.

In our own series of males this form is numerically equal to the one without submarginal bands, and several examples occur in which there are traces of these bands. *Ilmae* therefore represents one extreme of a range in variation of the normal male in which all intergrades occur.

In this same paper Watson describes a second "aberration," i.e. *nigrovenosa,* on the strength of a single example with unexpanded wings. The distinguishing feature of this "ab." is that "it has the bands heavy and the upper surface of the forewing and the under surfaces of both wings with black scales on the veins, from base as far as the black marginal band." It may be of interest to note that two examples in the Los Angeles Museum collection with wings fully expanded answer this description.

In the Entomological News for March, 1912, p. 97, Watson describes a third "ab." of *H. burnsi* which he calls *conjuncta,* and which he figures on plate VII. This he reports from Reno, Nevada. Again in 1913 the same author describes a fourth aberration of *burnsi* (*H. burnsi* ab. *paradoxa.* Ent. News, XXIV, p. 130), also from Reno.

The type locality for *Hemileuca burnsi,* Truckee Pass, may well be in California rather than Nevada, as it is not unlikely that the foodplant of this species extends from the desert areas about Reno, for a considerable distance up the canyon toward Truckee. We have found the larvae in abundance high in the Argus Mountains east of Owens Lake, and also at various points on the Mojave Desert. In 1892 the senior author took imagos in the San Gorgonio Pass east of Banning.

The foodplant of choice is *Tetradymia spinosa* H. & A. The larvae have been taken on *Parosela californica* (Wats.) Vail at Whitewater, Riverside County.

In captivity they may be successfully reared on *Eriogonum*.

Watson describes the egg as follows: "Grayish blue, glossy and faintly mottled; thickest near apex and a faint micropyle." He mentions that they are laid in clusters. In a state of nature they are grouped about a twig of foodplant, very frequently on a part of the bush that is dead. The cluster of eggs is not usually laid in as regular a grouping as with *H. nevadensis*. Plate 29 shows a group of eggs.

PLATE 29
Cluster of eggs of *Hemileuca burnsi*, enlarged.

The ova hatch in February or early March. The larva are gregarious during their first instar.

Larvae: first instar. Body color, black, covered with black branching spines—the accessory hairs of which are whitish or translucent. Head, and all legs, black.

Larva of 14 mm. length.

Head: shiny jet black, with a number of grayish-white single hairs scattered over the surface.

Body: velvety black, with a series of grayish white spots arranged in two irregular lines on each side.

A series of long multiple-branched spines cover the body, arranged in eight longitudinal rows (four on each side of the mid-dorsal area). All of these spines are black but the terminal tip of each spine is grayish white.

The spines of the latero-inferior row are absent on the segments containing the prolegs, where their place is taken by a number of single grayish short hairs.

True legs black: Prolegs black except on the ends which are soiled yellow.

Larva of 19 mm.

Same as previous stage except for the following points. The body is profusely covered with grayish punctate spots, except in the median dorsal line, where their absence gives the appearance of a dark line.

The two rows of median dorsal spines (one on each side) bear branches which are yellowish near the main stem, become black near the ends, and finally terminate in grayish filaments.

Mature larva. Length extended, averaging about 50 mm. Cylindrical; slightly tapering at both ends. Body, sooty black, heavily studded with small white round dots with black centers from which arise soft white hairs.

Mid-dorsally there is an absence of these dots at the front of each segment.

The segmental joints are bordered with irregular lemon-white small blotches.

Just below the spiracular line on each segmental juncture there is an arching lemon-white bar. These bars give the appearance of a broken sub-stigmatal line, which however is absent on the first three and last segments.

Spiracles, orange, with black rims.

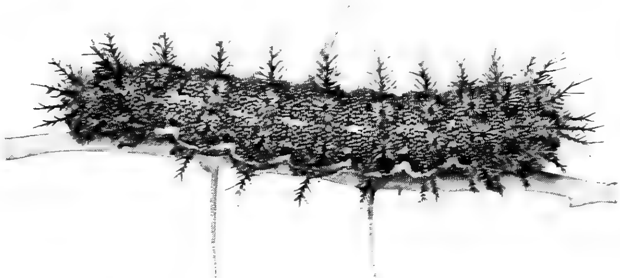


PLATE 30
Mature larva of *Hemileuca burnsi*, on twig of *Tetradymia*, enlarged x 1½.

The characteristic number of branching spines as before described. The branches on these spines black, with white bands just below their tips. The eleventh segment bears only seven spines, one being placed mid-dorsally. The caudal segment has only four spines.

The two rows of spines nearest the mid-dorsal line have clusters of stout short lemon-yellow spines at their bases. The tips of these yellow spines are black. The spines of the lower-

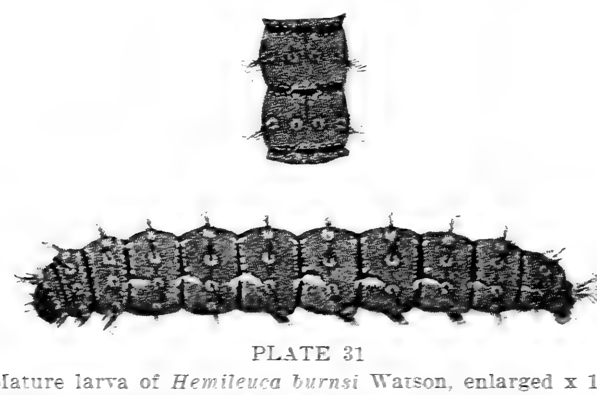


PLATE 31
Mature larva of *Hemileuca burnsi* Watson, enlarged x 1½.
Upper figure, dorsal aspect of two typical segments. Lower figure, lateral aspect of larva. This drawing is slightly diagrammatic, as the spines are somewhat reduced in scale, thus allowing a clearer definition of surface markings.
Reproduced from painting by Comm. Charles M. Dammers.

most two rows are similar, except that the clusters of stout short spines at their bases are white instead of yellow. As previously pointed out, the lowermost row of spines is absent on those segments bearing prolegs.

Abdomen concolorous with body. Legs, shiny black. Prolegs, gray with a broad black band laterally across each. Claspers gray with brown hooklets.

Head, shiny black, covered sparsely with short soft white hairs. The mature larva is illustrated on plates 30 and 31.

Pupation takes place during May, on or close to the surface of the soil amongst surface debris. A light silken cocoon is spun. Emergence occurs in September, October or November of the same year, but a certain number of pupae hold over for one or more years.

Watson described the pupa as follows: "Rounded and elliptical, tapering to the tail, rugose, three movable segments, the penultimate and last fused, the anterior edge of penultimate and posterior edge of last movable corrugated. Spiracles pouting. Cremaster of twelve to fifteen curved black bristles."

To this we can add: Length, ranging from 18 mm. to 29 mm., the average about 24 mm. Color, nearly black, but with a tinge of dark maroon.

Watson's figure of the pupa is too poor for any details of structure to be in evidence. It is also faulty in color, showing an excess of red. The accompanying plate 32 illustrates the three surfaces of a typical chrysalis.

a *b* *c*

PLATE 32
Pupa of *Hemileuca burnsi*, enlarged x approx. 2.
a, ventral; *b*, lateral, and *c*, dorsal aspects.

Synchlora liquoraria Gn.

Many moths of the subfamily Hemitheinae, commonly known in this country as the "Greens," and in Europe as the "Emer-

alds," furnish excellent examples of protective coloration and form. Not only are the imagos colored like the foliage which they frequent, but the larvae, so far as known, are shaped and colored in a manner that adapts them admirably to their environment. Several of them also have habits of movement and posture which further serve to conceal them.

Few of the North American species have been studied, so far as their early stages are concerned. Hulst[1] described the larva and pupa of *Racheospila rubrolinearia* Pack. Packard[2] figured, and briefly described the larva of *Nemoria brunnearia* and some work has been published by various authors on five other species of the genus *Nemoria*.

In the genus *Synchlora* we have somewhat more extensive knowledge, due probably to the fact that *S. aerata* Fabr. is of economic importance. Even with this interesting genus, however, there is a dirth of illustrations, notwithstanding the spectacular nature of the larval habits.

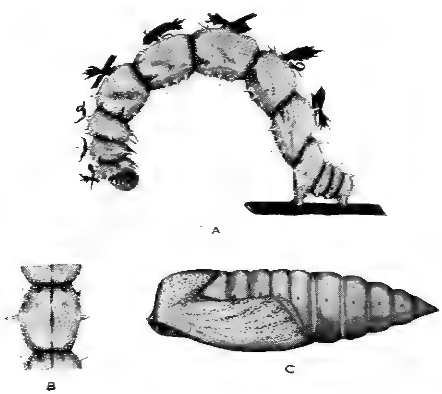


PLATE 33

Early stages of *Synchlora liquoraria Gn.*

A. Lateral aspect of mature larva, with camouflaged covering partly removed.

B. Dorsal aspect of typical segment.

C. Pupa, lateral aspect. All figures enlarged approximately x 3½.

Reproduced from painting by Comm. Charles M. Dammers.

Of the four species listed for the genus we have fragmentary records of *S. rubrifrontaria* Pack. and *S. excurvaria* Pack.

Synchlora aerata Fabr. has been well publicized by Dyar,[3] Saunders, French, Packard and Riley.

We have bred *Synchlora liquoraria* Gn. and find that it is similar in habits and general resemblance to larva of *S. aerata*.

The foodplants on which it has thus far been taken are Coreopsis, *Chilopsis linearis* DC., Golden-rod and *Eriogonum fasciculatum*. Doubtless it will be found on many other plants. In every case it feeds only on the flowers. Small parts of the blossoms are bitten off and placed over its back, each particle being very carefully attached to a spiculiferous process. If this covering is removed the larva immediately begins again to complete its camouflage. While resting the larva holds only by its caudal prolegs, and arches its body, as shown on plate 33. Thus its posture and covering both tend to heighten the illusion that it is a part of the plant.

[1] Entom. Amer., vol. 3, p. 72, 1887.
[2] Monogr. Geometr., p. 388, 1876.
[3] See Psyche., vol. IX, p. 93, 1900.

PLATE 34
Larva of *Synchlora liquoraria* Gn. covered with its camouflage and resting in a blossom of Eriogonum. The left hand portion of the flower tuft is the disguised larva. Plate 35 shows the same larva removed from its place of concealment.
Figures enlarged approximately x 3½.

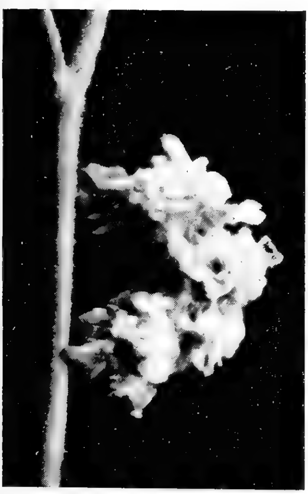


PLATE 35
Larva of *Synchlora liquoraria* Gn.
Enlarged approx. x 3½.

Plate 34 shows one of these larvae resting on a blossom of *Eriogonum.* The right-hand portion of the flower is growing. The left-hand portion is a larva, covered over by bits of blossoms which it has fastened to its back. In plate 35 this larva has been removed and placed on a twig without disturbing its covering.

This larva, when mature, measures approximately 14 mm. It ranges in color from a pale buff with various areas laved with maroon, to a deep buff heavily marked and striped with reddish brown. The pale type may be briefly described as follows:

Body, pale buff. A thin mid-dorsal maroon band showing on the segmental junctures, and center of each segment. (This band occasionally continuous and conspicuous.)

A line of maroon spots on the segmental junctures in line with the spiracle. A third line of similar spots midway between these and the mid-dorsal area.

The segmental joints show a maroon shading.

The dorsal surface of each segment is irregularly flattened and bears a number of spiculiferous white processes. Similar processes occur laterally and also are numerous along the lower edge of the body.

Under magnification, the body is seen to be completely covered with numerous minute raised pale buff punctae.

Abdomen, legs and prolegs concolorous with body.

Spiracles, brown.

Head, pale buff. Mouth parts brown.

Plate 33 gives a somewhat diagramatic presentation of this larva, the covering of attached particles being raised or partly removed to show the lateral aspect.

Pupation took place on the foodplant, a thin cocoon being formed into which the covering of flower particles originally serving as camouflage was incorporated.

Pupa: Length, 10 mm. Color, pale buff, the abdominal segments lighter. Cephalic end flattened. On each side of head above antennae, a short pointed prominence.

Thorax and wing cases rugose, the latter sparingly speckled with light brown. Spiracles, light brown.

Cremaster formed of six short stout dark brown hooks.

Plate 35 shows three aspects of the pupa.

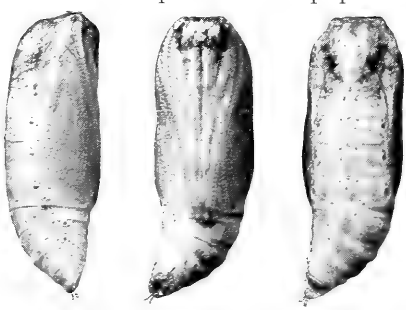


PLATE 35

Pupa of *Synchlora liquoraria* Gn., enlarged x 3½.
a. Lateral aspect. *b*. Ventral aspect.
c. Dorsal aspect.

Chlorosea naidaria Swett.

The habit of covering the body with bits of vegetation is not confined to the genus *Synchlora*. Hulst[4] in describing the larva of *Chetcoscelis bistriaria* Pack. records the same phenomena for this interesting Green.

He also mentions another habit of *bistriaria* larvae which we find occurring in others of the group, and which has special significance in the case of *Chlorosca naidaria* Swett. This is the

[4] Entom. Amer., vol. 3, p. 193, 1888.

peculiar trembling motion of the larva. With some species this is evidenced only when in the act of progressing, and under certain circumstances might cause the larvae to be conspicuous. With *Chlorosea naidaria,* however, we have a caterpillar which feeds in the blossoms (tassels) of oaks. This quivering motion exactly simulates the movement of the oak tassel in a gentle breeze, and it is therefore highly protective.

Furthermore, the form and coloration of this larva is such a close match for the oak tassel as to render it quite invisible.

Plate 37 clearly demonstrates the effectiveness of this disguise. In the upper figure the larva rests among the oak tassels where it is practically invisible. In the lower plate the same figure is reproduced but the larva is outlined in black. If separated from its surroundings as shown in plate 36, the caterpillar is boldly marked and readily observed.

The mature larva of *Chlorosea naidaria* may be briefly described as follows:

Length, 18 mm. Color of body, yellow-buff, with mottlings of brown, olive-brown and mauve.

In the mid-dorsal line, on the fifth to eighth segments are large raised white pyramidal tubercles, one to each segment. Caudal to each of these is a pair of small tubercles of somewhat similar type.

Mid-dorsally at the rear end of the eleventh segment is a pair of large pyramidal tubercles. Also, mid-dorsally, on the fourth segment there are two pairs of prominent tubercles. The second and third segments each bear a pair of similar tubercles in the same area.

In the dorso-lateral area there occurs a line of prominent somewhat sickle-shaped tubercles, one to each segment from the fourth to eighth. Each of these tubercles bears on its anterior edge a small accessory tubercle.

In the stigmatal line there occurs another series of tubercles, which are present on the fourth to ninth, and also the eleventh segments. These are acutely pyramidal in shape and like most of the other tubercles are laved with white.

PLATE 36
Larva of *Chlorosea naidairia* Swett, lateral aspect, enlarged approximately x 4.

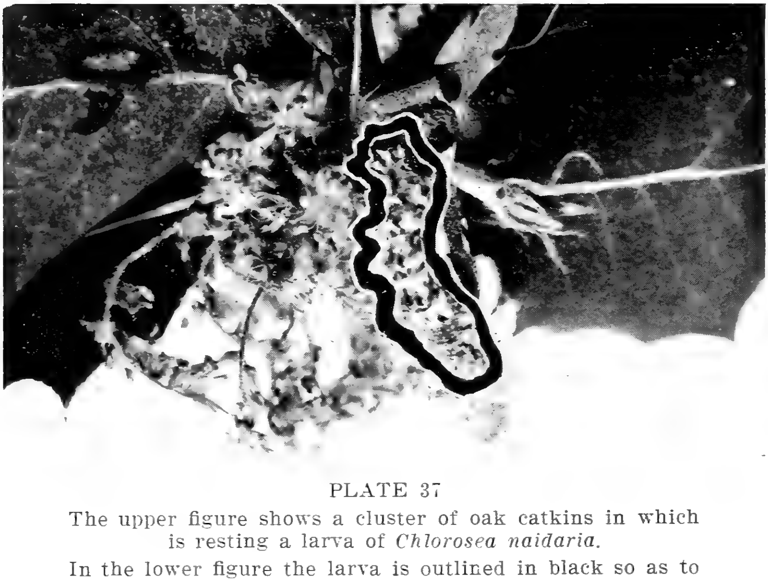


PLATE 37

The upper figure shows a cluster of oak catkins in which is resting a larva of *Chlorosea naidaria.*

In the lower figure the larva is outlined in black so as to distinguish it from its surroundings.

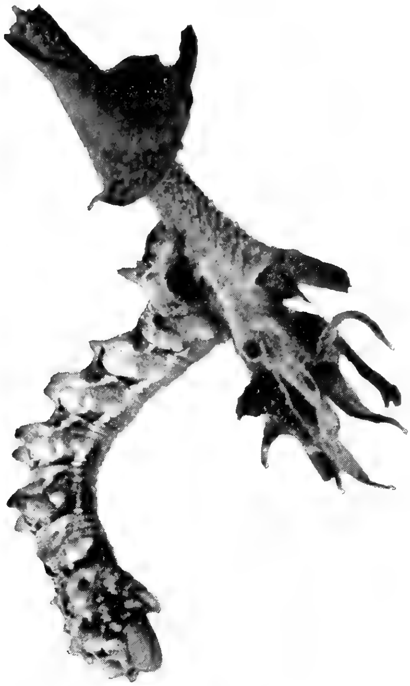
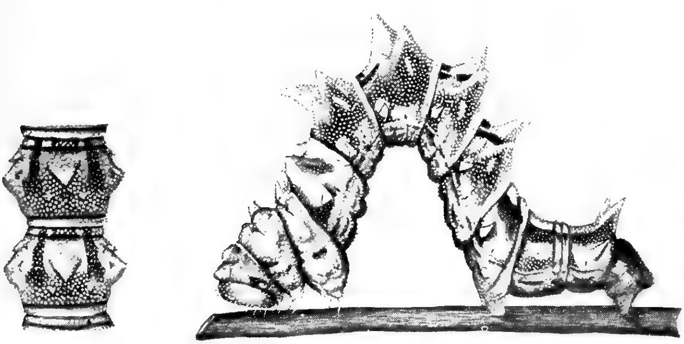


PLATE 38

Mature larva of *Chlorosea naidaria* hanging from oak tassel. Enlarged approximately x 4.



A B

PLATE 39

Mature larva of *Chlorosea naidaria* Swett.

A. Two typical segments, dorsal aspect.

B. Lateral aspect of larva.

Enlarged approximately x 4.

Reproduced from painting by Comm. Charles M. Dammers.

The disposition of the darker mottlings is best shown in the accompanying plates 38 and 39. There is considerable variation as regards these markings.

Spiracles, brown. Legs, buff with brown terminal points. Prolegs; anterior pair orange, caudal pair olive.

The segmental junctures are tinged with mauve. A few colorless hairs occur on the caudal segment.

Head, olive-yellow. Ocelli, blackish-brown. Clypeus and antennae, yellow. A few short yellowish hairs occur on the lower part of the face.

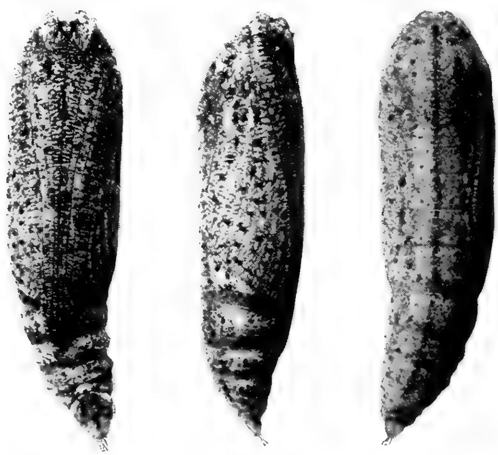
The entire larva is thickly covered with minute light punctae.

Pupation occurs on the foodplant usually in late May, a fragile cocoon being spun in which dried fragments of the oak tassel are incorporated.

Pupa: Length, approximately 13 mm. Varying from a uniform light tan, with numerous brown spots, to a pale buff on wing cases, head, thorax and caudal segment, with chestnut on the body.

The posterior half tapers gently to the cremaster. Cremasteric hooks very minute. The pupa is illustrated on plate 40.

Emergence occurs in March of the year following pupation, there being only one brook a year. Occasional captures are made in January and February, if weather conditions are favorable.



a *b* *c*

PLATE 40

Pupa of *Chlorosea naidaria* Swett.

a. Ventral aspect. *b*. Lateral aspect. *c*. Dorsal aspect.

Enlarged approximately x 4.

A NEW SPECIES OF DYSLOBUS WITH NOTES ON VESTIGIAL HIND WINGS AND GENITALIA AS CHARACTERS IN THE OTIORHYNCHID WEEVILS (Otiorhynchinae-Coleoptera)

By Peter C. Ting
State Department of Agriculture, San Francisco, California

A new species of the genus *Dyslobus* is herein described which has been recently collected in the city of San Francisco. A few notes are added on the structure of the vestigial hind wings and genitalia of both sexes, which are the results of a further attempt to describe the species' position within the genus. The writer wishes to acknowledge specimens given him for dissection by Dr. E. C. Van Dyke, Mr. Mont Cazier, Mr. A. T. McClay, and Mr. F. R. Platt.

Dyslobus alepidotus Ting, New Species.

Male: Form slender elongate. Color predominately dark brown with longitudinal rows of alternately-placed white and dark patches on first, third, and fifth interspaces of the elytra; tubercles at base of declivity white and forming a pronounced, transverse V-shaped pattern. Head granulose between and behind eyes with many golden recumbent setae and a few suberect dark setae; base of head with shallow pits bearing white serrate scales; rostrum rugose dorsally with fewer golden and white raised setae and very few suberect dark setae, underneath with large deep punctures, separated from vertex by transverse constriction in front of eyes, no median carina; eyes slightly convex near dorsal margin; antennae with scape reaching slightly beyond hind margin of eyes, funicle with first and second segments elongate and subequal, third to seventh shorter but longer than broad, seventh distinctly broader than sixth, club fusiform widest at apex of first apparent segment. Prothorax broader than long (2.6 mm. to 2.2 mm.) with large, closely-placed, seta-bearing granules a few of which run together forming rugose ridges; a faint median depression near anterior margin; sides convex and slightly constricted at base and apex; faint tubercles behind front coxae. Mesosternum with white fan-shaped scales, deeply toothed at apices. Mesosternal episternum anteriorly with large round punctures bearing same toothed scales, posteriorly with shallower punctures bearing white setae. Metasternum with setae, only no scale-like setae. Elytra nearly twice as long as broad; humeral angles well defined; serial punctures large and deep, each bearing a hair-like seta; vestiture (fig. A) entirely of setae—no scale-like setae (fig. C) present as in other species of the genus, many suberect, dark setae three times as long as the primary setae; interspaces 1-3-5 raised and each forming a large

tubercle at base of declivity. Sternites of abdomen sparsely covered with fine golden setae; last visible sternite slightly depressed on either side but flat in middle. Legs with closely placed scale-like setae on tibiae and a few scattered ones on femora; front femora more swollen than others. Genitalia distinct from *granicollis* and *tumidus* with median lobe greatly constricted and flattened laterally near apex forming a sickle-shaped structure convex dorsally; internal sac with two large teeth near apex which are four times longer than broad, many short teeth are present.

Female: Similar to male except for following: Rather robust instead of elongate; serial punctures of elytra smaller; interspaces of elytra slightly less raised; front femora less swollen; last abdominal sternite constricted on either side of median line giving it a keeled appearance; genitalia definitely that of the genus *Dyslobus*. Holotype male length, exclusive of head, 7 mm., width 3 mm. Allotype female length 7.5 mm., width 4 mm. Other typical specimens 6.8 mm. to 8.3 mm. in length. One dwarf female 5.7 mm. in length.

Type locality: Sigmond Stern Grove, San Francisco, Calif.

Host: *Rubus vitifolius*.

Holotype male and allotype female (Catalog Nos. 4489 and 4490) in the entomological museum of the California Academy of Sciences, San Francisco. Described from a series of one-hundred and fifty-one specimens, two of which were collected by the author on March 14 and 29, 1936, and the remaining by Mr. Mont Cazier and the author on April 2, 1937. All specimens were collected in an area of a few square yards. One hundred paratypes have been designated and will be placed in the collections of the California Academy of Sciences, the State Department of Agriculture, San Francisco; Mr. Mont Cazier, United States National Museum, Dr. E. C. Van Dyke, Los Angeles Museum, and that of the author.

This species superficially resembles *granicollis* and would run there in Van Dyke's key[1] but it is distinct from *granicollis* and all other known species in the genus by the total absence of scale-like setae on the elytra and pronotum. A study of the

---

[1] A Short Review of Dyslobus Leconte, a Genus of Broad-nosed Weevils of the Subfamily Otiorhynchinae with Descriptions of New Species. Pan-Pacific Ent., vol. IX, no. 1, pp. 31-47, 1933.

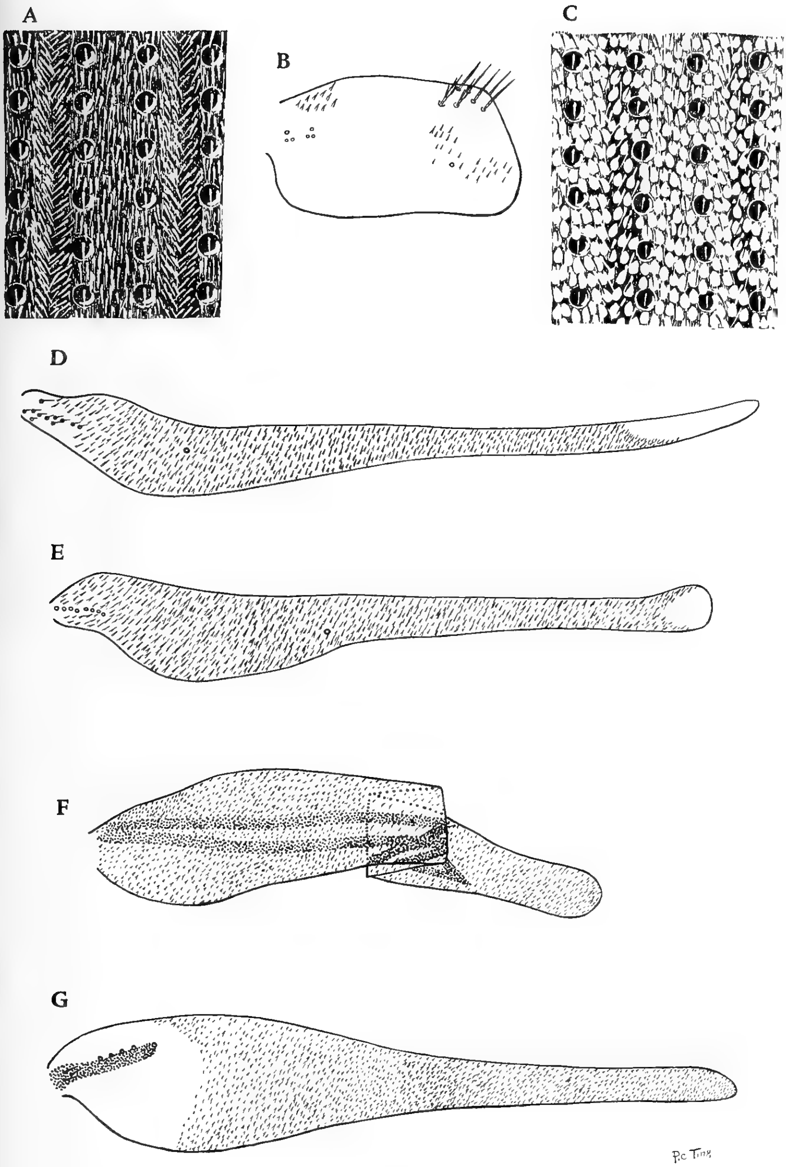


PLATE 41

male genitalia indicates that it is most closely related to *tumidus* of the *granicollis* group.

An examination of the vestigial hind wings of fourteen species in the genera *Dyslobus, Adaleres, Panscopus,* and *Eupagoderes* (see figs. B, D, E, F, G) indicates that these structures, although varying but little in specimens of the same species, are of little use as specific characters because of their close similarity in different species and the difficulty of putting these slight differences into words. However, they should be helpful in phylogenetic studies. Since all the species in these genera are said to be incapable of flying, it is reasonable to believe that wing reduction is reaching a near minimum and that occasional specimens retaining more fully developed wings will not be found.

An examination of the male genitalia in the same species, however, rather definitely indicates that these structures are excellent characters and should be studied to substantiate the other more obvious ones. The armature of the internal sac as well as the median lobe present many usable characters. The female genitalia vary little in species of a given genus and appear to be excellent generic characters. For example, the female genitalia of *Panscopus, Adaleres,* and *Dyslobus* are strikingly different, but similar in the species of each genus.

EXPLANATION OF FIGURES—PLATE 41

(Illustrations of new species from paratype female.)

Fig. A. *Dyslobus alepidotus* New species, section of elytron showing arrangement of setae and punctures.

Fig. B. *Eupagoderes geminatus* Horn, right metathoracic wing.

Fig. C. *Dyslobus granicollis* (Lec.), section of elytron showing arrangement of scale-like setae, other setae, and punctures.

Fig. D. *Dyslobus alepidotus* New species, right metathoracic wing.

Fig. E. *Dyslobus granicollis* (Lec.), same.

Fig. F. *Adaleres humeralis* Csy., same, but showing method of folding —only example found in twenty dissections.

Fig. G. *Panscopus abruptus* Csy., same, showing trace of vein.

THE STATUS OF PHYLLOPHAGA CRIBROSA (LE CONTE) (COLEOPTERA: SCARABAEIDAE)

By Jack C. von Bloeker, Jr.
University of California

Tostegoptera cribrosa was described by John L. Le Conte in 1853. Later in the same year two additional species, *T. ventricosa* and *T. aequalis,* were described by this same author. In 1856, Le Conte erected a new generic name, *Eugastra,* for the first two species on the character of the deep emargination of the ligula, the apterous character of both sexes, and the glabrous character of the body above and below; *T. cribrosa,* the first named species, was properly designated as the genotype at this time. Dr. George H. Horn demonstrated, by the dissection of many species of *Phyllophaga,* that the emargination of the ligula had no generic value and in 1887 he placed *cribrosa* with the genus *Lachnosterna* and reduced the name *ventricosa* to synonymy under the former species. H. W. Bates (1890) revived the name *Eugastra* to receive the species *cribrosa, aequalis,* and *farcta,* combining the features indicated by Le Conte with the further characters of "the extremely short metasternum and the subterranean or epigeous habits of the species." In the instance of the species *Lachnosterna farcta* an exception had to be made to include it for both sexes are winged. Dr. R. D. Glascow (1916) refers all three species to *Phyllophaga* without reference to *Eugastra.*

In the present writer's study of the genus *Phyllophaga,* the conclusion has been arrived at that, while these species undoubtedly belong to this genus, at least one of them falls naturally into a group with a species, *Eugastra epigaea,* described in 1903 by H. F. Wickham, which may be properly designated as a subgenus. *P. farcta* has been removed from these on the basis of the possession of functional wings and other characters which will be discussed in a later paper. The species *aequalis* belongs to the subgenus *Tostegoptera,* previously reviewed by the present writer in this bulletin (Jan.-Apr., 1936:52-61), but because it is known so far only from a unique female it is omitted from discussion at the present time. The name *ventricosa* is resurrected to assume subspecific status under *cribrosa,* as designated below. Le Conte's name *Eugastra* is herein employed for this group, with the re-description of the subgenus given below:

Subgenus Eugastra Le Conte.

Le Conte, Journ. Acad. Nat. Sci. Philadelphia, ser. 2, no. III, p. 234, 1856.

Body robust (female gibbous, more robust than male); above glabrous and coarsely punctate, piceous black; mesosternum nearly glabrous and sparsely punctate; abdomen glabrous, finely punctate; antennae 10-segmented; wings vestigial, incapable of supporting the body in flight; spurs of hind tibiae movable; tooth of claw subbasal.

Type species: *Phyllophaga cribrosa* (Le Conte).

Range: Arizona, New Mexico, Texas, Oklahoma, Kansas, and Neuvo Leon, Mexico.

Phyllophaga cribrosa cribrosa (Le Conte).

Tostegoptera cribrosa Le Conte, 1853.

Eugastra cribrosa, Le Conte, 1856; Bates, 1890; Wickham, 1903.

Lachnosterna cribrosa, Horn, 1887; Smith, 1889.

Phyllophaga cribrosa, Glascow, 1916.

General form: Male robust ovate, slightly convex dorsally, tapering gradually posteriorly; female robust gibbous, inflated posteriorly; humeral region constricted.

Characters: Antennal club slightly longer than one-half length of stem; margin of clypeus reflexed, faintly sinuate at middle, coarsely and densely punctate; head punctate as in clypeus, occiput more finely punctate; pronotum short and broad, widest at middle, sides convergent in anterior half, nearly straight, sinuate in posterior half, margins of sides strongly crenate in anterior half, surface coarsely punctate, the punctures becoming larger and less dense basally; scutellum transverse and densely punctate; elytra piceous, faintly shining, costae usually ten in number, distinct, elytra coarsely punctate between costae; mesosternum with extremely sparse vestiture of golden brown hairs, irregularly, coarsely punctate; abdomen finely, sparsely punctate, each puncture with a very short, yellowish hair, a flattened or depressed median area extends from segment two to the anterior edge of terminal segment, this area nearly impunctate; terminal segment narrow, transversely grooved; pygidium broader than long, sparsely, coarsely punctate, slightly convex medially and apically; spurs of hind tibiae broad, blunt and slightly decurved, upper twice length of lower; tooth of claw strong, right-angled.

Measurements: Male—Length 17.0 mm., width 10.5 mm. Female—Length 19.0-19.5 mm., width 11.5-12.5 mm.

Specimens examined: Forty-three, as follows—Texas: Amarillo, Potter County, 5; Austin, Travis County, 1; Beaumont, Jefferson County, 2; Breckenridge, Stephens County, 3; Laredo, Webb County, 4; Rio Grande, Starr County, 2; San Antonio,

Bexar County, 4; Vernon, Wilbarger County, 3; Waco, McLennan County, 2. Oklahoma: Cherokee, Alfalfa County, 3; Oklahoma City, Oklahoma County, 2; Shawnee, Pottawatomie County, 2; Tulsa, Tulsa County, 1. Kansas: Dodge City, Ford County, 1; Great Bend, Barton County, 3; Manhattan, Riley County, 2. Neuvo Leon, Mexico: Juarez, 1; Monterey, 2.

Remarks: In the original description of *cribrosa,* Le Conte cited no definite type locality beyond the simple ascription "from the Mexican Boundary region of Texas." However, since the type locality of *ventricosa* was positively designated as "the vicinity of Eagle Pass . . . ," which is also in the Mexican Boundary region of Texas, the type locality of the subspecies *cribrosa* may be properly restricted to the southeastern part of Texas, near the Mexican Boundary. The metropolis of the race *cribrosa* apparently lies in central Texas, while that of *ventricosa* is situated further west, in southern New Mexico.

Phyllophaga cribrosa ventricosa (Le Conte)

Tostegoptera ventricosa Le Conte, 1853.

Eugastra ventricosa, Le Conte, 1856.

Lachnosterna cribrosa, Horn, 1887; Smith, 1889.

Eugastra cribrosa, Bates, 1890.

Phyllophaga cribrosa, Glascow, 1916.

General form: Similar to *cribrosa,* but smaller.

Characters: Similar to *cribrosa*, but differing in the following points: anterior margin of clypeus without median sinuation, more broadly reflexed; pronotum more convex, punctures smaller and more evenly arranged; elytra more distinctly sulcate, costae less well defined; abdomen without median depressed area; pygidium longer than broad; spurs of hind tibiae broader and nearly equal to each other in length.

Measurements: Male—Length 15.0 mm., width 9.0 mm. Female—Length 17.5-18.5 mm., width 10.5-11.0 mm.

Specimens examined: Thirty-six, as follows—Arizona: Ajo, Pima County, 3; Cochise, Cochise County, 1; Douglas, Cochise County, 1; Gila Bend, Maricopa County, 3; Globe, Gila County, 2; Nogales, Santa Cruz County, 2; Webb, Cochise County, 2. New Mexico: Carlsbad, Eddy County, 4; Las Cruces, Dona Ana County, 1; Lordsburg, Hidalgo County, 2; Silver City, Grant County, 2; Tularosa, Otero County, 3. Texas: Alpine, Brewster County, 3; Del Rio, Val Verde County, 1; Eagle Pass (type locality), Maverick County, 2; Marathon, Brewster County, 2; Marfa, Presidio County, 2.

Remarks: Since the name *ventricosa* was first relegated to synonymy by Dr. Horn in 1887, subsequent workers on *Phyllophaga* have been content to allow it to remain there undisturbed. This has been due largely, I believe, to the lack of adequate series for comparison and the inability on the part of the researchers to find sufficient characters in the genitalia to warrant the retention of the name in specific status as originally proposed by Le Conte.

The situation which allows so many of our modern workers to place such emphasis upon genital characters as to practically exclude from consideration all other characters of morphology is but deplorable. It does not appear logical that two forms morphologically identical in all characters save the genitalia should be designated as distinct species; neither does it appear logical that two forms morphologically dissimilar in all save genital characters should be considered as the same binomial species, though unquestionably they should not rank higher than geographic races. In the present instance, there are no outstanding differences between the genitalia of *cribrosa* and *ventricosa,* but there are certain definite external morphological differences which cannot be overlooked, and I deem it best to recognize them by name as designated above.

Phyllophaga epigaea (Wickham)

Eugastra epigaea Wickham, 1903.

Phyllophaga epigaea, Glascow, 1916.

General form: Similar to *cribrosa,* but less gibbous.

Characters: Above coarsely, but sparsely punctate; clypeus slightly emarginate, margin narrowly reflexed; pronotum half again as wide as long, sides evenly rounded; scutellum broad and smooth, relatively shorter in female; elytra piceous, surface not sulcate, sutural costae distinct, remaining costae obsolete; below smooth, finely but very sparsely punctate; mesosternum nearly glabrous, hairs very short; abdomen glabrous, without depressed area, gibbous as in *ventricosa;* pygidium alutaceous, indictinctly punctate; spurs of hind tibiae similar to those of *cribrosa,* lower equals two-thirds length of upper; tooth of claw short and sharp, right-angled.

Measurements: Male—Length 12.5-13.0 mm., width 7.0-7.5 mm. Female—Length 14.0-14.5 mm., width 9.0-9.5 mm.

Specimens examined: Twelve, as follows — New Mexico: Las Cruces, Dona Ana County, 2. Texas: Alpine, Brewster County, 2; Del Rio, Val Verde County, 4; Marathon, Brewster County, 1; Marfa, Presidio County, 3.

Remarks: This species is remarkably distinct from *cribrosa* in many of its characters. Its geographic range apparently parallels the central southern portion of the range of the race *ventricosa*. It corresponds with this latter race in the gibbous or ventricose character of the median ventral surface of the abdomen. However, in size it is smaller than either of the subspecies of *cribrosa*.

Acknowledgment

For the loan of much valuable material for use in connection with the present report, the writer wishes to express his appreciation to the following persons: Messrs. E. R. Leach and M. A. Cazier made generous loans of specimens from their private collections; Mr. E. P. Van Duzee made available the specimens in the California Academy of Sciences; and Dr. E. C. Van Dyke, of the University of California, held accessible important references in his private library, read the manuscript, and offered valuable suggestions and criticisms in regard to the study. These men are continuing, in their fine spirit of coöperation, to render the problems in connection with the revision of the genus *Phyllophaga* increasingly easier to solve.

The difficulty entailed in securing funds for the publication of such a large report as would be required to discuss this widespread and highly diversified genus completely in a taxonomic revision appears insurmountable at the present time. Therefore, it has been deemed advisable to publish the results of the studies in a number of separate papers, each to appear shortly after it has been completed. In this way the information will be made accessible as soon as possible and, at the same time, will permit of more complete treatment of each separate group.

Bibliography

Bates, H. W., 1886-1890. Biologia Centrali-Americana, vol. II, part 2, Insecta: Coleoptera—Pectinicornia and Lamellicornia.

Glascow, R. D., 1916. *Phyllophaga* Harris (*Lachnosterna* Hope): A revision of the synonymy and one new name. Bull. Ill. State Lab. Nat. Hist., vol. XI, art. V, pp. 365-379, February.

Horn, G. H., 1887. Revision of the species of *Lachnosterna* of America, north of Mexico. Trans. Am. Ent. Soc., vol. 14, pp. 209-296, December.

Le Conte, J. L., 1853. Descriptions of twenty new species of Coleoptera inhabiting the United States. Proc. Acad. Nat. Sci. Phila., pp. 226-235, January.

————. Descriptions of some new Coleoptera from Texas, chiefly collected by the Mexican Boundary Commission. Proc. Acad. Nat. Sci. Phila., pp. 439-448, December.

————, 1856. Synopsis of the Melolonthidae of the United States. Journ. Acad. Nat. Sci. Phila., ser. II, vol. III (*Eugastra*, p. 234).

Sim, R. J., 1928. *Phyllophaga* (Scarabaeidae) of the United States and Canada. Part I. Circ. 145, N. J. State Dept. Agr., 60 pp., 6 figs., 12 pls., May.

Smith, J. B., 1889. Notes on the species of *Lachnosterna* of temperate North America with descriptions of new species. Proc. U. S. National Mus., vol. XI, no. 747, pp. 481-525, pls. XLVIII-LX.

Wickham, H. F., 1903. New Coleoptera from the western United States. Canad. Ent., vol. 35, no. 3, pp. 67-74, March.

BULLETIN of the SOUTHERN CALIFORNIA
ACADEMY of SCIENCES

Published by the Academy at Los Angeles, California
Subscription—$2.00 per year

Free to Life Members and Unlimited Annual Members
of the Academy (Annual Membership Fee $5.00)

Address all communications to Dr. John A. Comstock

Care of Los Angeles Museum, Exposition Park,

Los Angeles, Calif., U. S. A.

Publications of the
Southern California Academy of Sciences

The Academy has published to date the following:

PROCEEDINGS, 1896 to 1899. Six numbers—Vol. 1, Nos. 1 to 6.

MISCELLANEOUS BULLETINS issued under the imprint of the Agricultural Experiment Station, 1897 to 1907. *Ten numbers.*

All issues of the above are now out of print.

■ ■

Bulletin of the
Southern California Academy of Sciences

Began issue with Vol. 1, No. 1, January, 1902. Issued ten numbers in 1902; nine numbers in 1903, 1904, 1905; three numbers in 1906. Issued two numbers annually from 1907 to 1919, both inclusive (except 1908—one issue only). Issued four numbers (January, May, July and October) in 1920.

The 1921 issues are: Vol. XX, No. 1, April; Vol. XX, No. 2, August; Vol. XX, No. 3, December.

The 1922 issues are: Vol. XXI, No. 1, March; Vol. XXI, No. 2, September.

The 1923 issues are: Vol. XXII, No. 1, March; No. 2, July.

The 1924 issues are: Vol. XXIII, No. 1, January-February; No. 2, March-April; No. 3, May-June; No. 4, July-August; No. 5, September-October; No. 6, November-December.

From 1925 to 1936, including volumes XXIV to XXXV, three numbers were published each year. These were issued as No. 1, January-April; No. 2, May-August; No. 3, September-December, for each volume.

PUBLICATIONS OF THE SOUTHERN CALIFORNIA ACADEMY OF SCIENCES

For Sale at the Appended Prices

BULLETIN:

	To Members	To Non-Members
Complete set, Vols. 1 to 33, bound		$100.00
(Incomplete set) Vols. 8 to 33, bound		80.00
Vol. 3, No. 7, 1904	$ .25	.50
" 4, " 5, 1905	.25	.50
" 6, " 1, 1907 (Photostat only)	2.00	4.00
" 6, " 2, 1907	.25	.50
" 7, " 1, 1908	1.00	2.00
" 8, " 1, 1909	1.00	2.00
" 9, " 1, 1910	2.00	4.00
" 9, " 2, 1910	.75	1.50
" 10, " 1, 1911	1.00	2.00
" 10, " 2, 1911	2.00	4.00
" 11, " 2, 1912	1.00	2.00
" 12, " 1, 1913	1.00	2.00
" 15, " 2, 1916	.75	1.50
" 16, " 2, 1917	1.00	2.00
" 17, " 1, 1918	2.00	4.00
" 17, " 2, 1918	1.50	3.00
" 18, " 2, 1919	2.00	4.00
" 19, " 1, 1920	.50	1.00
" 19, " 4, 1920	.50	1.00
" 20, " 1, 1921	2.00	4.00
" 20, " 2, 1921	2.00	4.00
" 20, " 3, 1921	2.00	4.00
" 21, " 1, 1922	2.00	4.00
" 21, " 2, 1922	1.00	2.00
" 22, " 1, 1923	1.50	3.00
" 22, " 2, 1923	2.00	4.00
" 23, " 1, 2, 3, 4, 5, 6, 1924 (each)	.25	.50
" 24, " 1, 2, 3, 1925 (each)	.25	.50
" 25, " 1, 1926	2.00	4.00
" 25, " 2, 3, 1926 (each)	.25	.50
" 26, " 1, 2, 3, 1927 (each)	.25	.50
" 27, " 1, 2, 3, 1928 (each)	.25	.50
" 28, " 1, 2, 3, 1929 (each)	.25	.50
" 29, " 1, 2, 3, 1930 (each)	.25	.50
" 30, " 1, 2, 3, 1931 (each)	.25	.50
" 31, " 1, 2, 3, 1932 (each)	.25	.50
" 32, " 1, 2, 3, 1933 (each)	.25	.50
" 33, " 1, 2, 3, 1934 (each)	.25	.50
" 34, " 1, 2, 3, 1935 (each)	.25	.50
" 35, " 1, 2, 3, 1936 (each)	.25	.50
" 36, " 1, 2, 1936 (each)	.25	.50

Miscellaneous, Publications of Affiliated or Co-operating Organizations:

Lorquinia—Vols. 1, 2 (all published)...bound $1.50, unbound $1.00

Southern California Geology and Los Angeles Earthquakes, R. T. Hill .... bound 5.00

Southwest Science Bulletin, May 5, 1920 (all published), chiefly Entomological, 1 colored plate 1.00

Check-list of the Recent Bivalve Molluscs (of N. W. Coast of Am. from the Polar Sea to San Diego), W. H. Dall 1.00

(Continued on next page)

PUBLICATIONS (*continued*)

Reprints:

Check-list of the Lepidoptera of Boreal America. Superfamilies Sphingoidea, Saturnioidea and Bombycoidea (printed on one side of page only, to allow of additional notes), Wm. Barnes and Foster H. Benjamin, 1927 ....$ .50

The Cacti of the Pyramid Peak Region, Dona Ana County, New Mexico, 1931. F. R. Fosberg .... .25

ADDRESS ALL INQUIRIES TO

SOUTHERN CALIFORNIA ACADEMY OF SCIENCES

(Care DR. JOHN A. COMSTOCK)

Los Angeles Museum, Exposition Park,

Los Angeles, California, U. S. A.

The work of the Southern California Academy of Sciences is carried on entirely through the generosity of private citizens, who are sufficiently interested in the advancement of education and cultural endeavor to donate funds or make bequests to the Academy. As a guide, in the matter of bequests, for those who plan to further this program, the following forms are suggested:

Form of Legacy

To be used when it is desired to leave the Academy any personal property, such as money, stocks, bonds, works of art, or other objects of value.

I give and bequeath unto "Southern California Academy of Sciences," of the City of Los Angeles, the sum of.. Dollars: To have and possess the same unto the said "Southern California Academy of Sciences," its successors and assigns, to the uses, dispositions and benefits thereof forever.

Form of Devise

To be used when it is desired to leave real estate to the Academy.

I give and devise to "Southern California Academy of Sciences" of the City of Los Angeles, (.. here describe the property or ground rent..), together with the appurtenances, in fee simple, and all policies of insurance covering said premises, whether fire, title or otherwise, free from all taxes: To have and to hold the same unto the said "Southern California Academy of Sciences," its successors or assigns forever.

REPRINTS: Contributors of articles accepted for publication in the Bulletin should order reprints, if desired, when they return galley proof to the editor. They may be ordered through the editor at the following rates, from the McBride Printing Co., 261 So. Los Angeles St., Los Angeles, Calif., the contributor paying for all his reprints.

PRICE LIST OF REPRINTS

	4pp.	8pp.	12pp	16pp	20pp.	24pp.	28pp.	32pp.
50 copies	$3.75	$ 5.75	$ 8.50	$10.25	$11.75	$13.50	$16.00	$17.00
100 "	4.50	7.50	10.75	12.75	15.00	17.25	20.25	21.50
150 "	5.25	9.25	13.00	15.25	18.25	21.00	24.50	26.00
200 "	6.00	11.00	15.25	17.75	21.50	24 75	28.75	30.50
250 "	6.75	12.75	17.50	20.25	24.75	28.50	33.00	35.00
300 "	7.50	14.50	19.75	22.75	28.00	32.25	37.25	39.50

Covers: 50 for $2.00. Additional covers, 1½c each.

California State 3% Sales Tax to be added if delivered within the State.

BULLETIN OF THE

Southern California Academy of Sciences

LOS ANGELES, CALIFORNIA

Nostra tuebimur ipsi.

Vol. XXXVI September-December, 1937 Part 3

CONTENTS

Issued January 25, 1938

Southern California Academy of Sciences

HALIOTIS KOTICKI, A NEW SPECIES FROM THE LOWER MIOCENE OF CALIFORNIA

By Leo George Hertlein

A specimen of a fossil shell belonging to the genus *Haliotis*, the well known abalone shell, was collected by Mr. O. F. Kotick of the Tidewater-Associated Oil Company. This specimen was brought to my attention by Mr. C. C. Church of the same company. The writer wishes to acknowledge assistance received from Dr. G. D. Hanna in the preparation of the manuscript.

Acknowledgment is also made to Mr. Frank L. Rogers who has prepared the photographs included in this paper. These photographs are the result of work accomplished as a part of a Government Works Progress Administration project.

The genus *Haliotis* is known in the upper Cretaceous of California, one species *Haliotis lomaënsis* Anderson[1] having been described from Point Loma, San Diego, California. The genus has also been reported from the Maestrichtian, upper Cretaceous of Belgium, upper Cretaceous of Sweden, and of Africa, and from the Eocene-Oligocene of Australia. Two species have been described from the Miocene of California, *H. lasia* Woodring from the Miocene of the Temblor Range, and *H. palaea* Woodring from the Modelo formation, upper Miocene of the Santa Monica Mountains. *Haliotis* is also known in the Miocene of Australia, Europe, Island of Cyprus, and Asia Minor. It is known in the Pliocene of California and Lower California, Japan, New Zealand and Barbados Island. At the present time it is known to occur in Europe, Africa, the Indian Ocean, Pacific Ocean, China, Japan, Australia, New Zealand, Alaska to Lower California, Galapagos Islands, where *Haliotis dalli* Henderson[2] is known, and one species lives in the Caribbean Sea, *Haliotis pourtalesii* Dall.

---

[1] *Haliotis lomaënsis* Anderson, Proc. Calif. Acad. Sci., Ser. 2, Geol., Vol. 2, no. 1, December 24, 1902, p. 75, pl. 9, fig. 183. "Point Loma," "Lower Chico of San Diego County, California."

[2] *Haliotis* (*Padollus*) *dalli* Henderson, Proc. U. S. Nat. Mus., Vol. 48, May 22, 1915, p. 661, pls. 45, 46, lower figures. New name for *Haliotis pourtalesii?* Dall, Dall, Proc. U. S. Nat. Mus., Vol. 12, 1890, p. 355, pl. 12, figs. 1, 3. "in 33 fathoms, sand; near Charles Island, of the Galapagos group, in the Pacific." Not *Haliotis* (*Padollus*) *pourtalesii* Dall, Bull. Mus. Comp. Zool., Vol. 9, no. 2, 1881, p. 79. "Bed of the Gulf Stream in 200 fathoms, near Florida Reefs." — Henderson, Proc. U. S. Nat. Mus., Vol. 48, 1915, p. 660, pls. 45, 46, upper figures. "Dredged about 3 miles off Sand Key, Florida, in 90 fathoms, on sand patches among rocks, on the edge of the 'Pourtales Plateau'."

The species here described is quite distinct from the two Miocene species previously described by Woodring from California where the genus is rare as a fossil but very common living. The resemblance of the Miocene species to the Recent forms suggests that the group was probably well established in this region in the Miocene. Mr. Kotick supplied the following section at the type locality of the species he collected:

1,900 feet ±	Hard, brittle, light gray to buff, thin bedded, silicious shale. (Monterey.)
700 feet	Light gray to brown, brittle, massive, silty shale. (Monterey series containing possibly some Temblor at the base.)
	— — — — — Unconformity — — — — —
20 feet	Conglomerate of serpentine pebbles and red and black Franciscan chert pebbles imbedded in medium to fine, muddy, sandstone matrix. (Vaqueros.) *Haliotis.*
400 feet ±	Medium to fine, muddy, dull gray sandstone. (Vaqueros.)
	— — — — — Unconformity — — — — —
	Franciscan.

Haliotis koticki Hertlein n. sp.

Plate 42, figures 1 and 2

Shell of medium size, fairly heavy sculpture and apparently with about five holes. Apex close to the edge of the shell. Shell angulated along the row of perforations. A shallow groove occurs between the angulation and the edge of the shell. The sculpture consists of concentric spiral cords which cross stronger, elevated, wavy corrugations. The ornamentation on the early third of the shell is oblique transverse from the beak to the angulation, but the remainder of the shell has the strong wavy corrugations arranged roughly in a radiate pattern and which run obliquely anteriorly forming an acute angle with the angulation. The spiral cords are visible in places where not obliterated but these are not so pronounced as the wavy sculpture. Height, 99.6 mm., width (approximately), 71 mm.

Holotype: No. 286 (Calif. Acad. Sci. Paleo. Type Coll.), from immediately below a bed of conglomerate 20 feet thick, 10,200 feet south 70½° west from Zaca Peak, and 13,600 feet east and 4,400 feet south of the northeast corner of La Zaca

Rancho; central eastern part of Lompoc quadrangle, U. S. Geol. Surv. Topographic map, Santa Barbara County, California: O. F. Kotick, collector: upper Vaqueros, lower Miocene. Other species occurring at the type locality include *Lucina acutilineata* Conrad, *Pecten miguelensis* Arnold and *Trophosycon* cf. *ocoyanum* Conrad.

The elongate shape and the position of the apex near the edge of the shell, the well-developed supra-marginal groove, and the large wavy corrugations, all bear a general resemblance to *Haliotis kamtschatkana* Jonas[3] which is reported to occur in the Kamtschatka Sea, Japan, and from Sitka, Alaska, to Redondo, California. The fossil species has more numerous wavy enlongate ridges which are arranged in a more radiate pattern.

Haliotis koticki bears some resemblance to the Recent *H. corrugata* Mawe[4] reported to occur in the middle Pliocene of southern California, and which is said to range at the present time from Monterey, California, to San Quintin Bay, Lower California. The new species has less rugose ornamentation and the groove between the angulation and the edge of the shell is more pronounced and wider in the fossil form than in *H. corrugata*. Furthermore the apex is nearer the edge of the shell than in the Recent *corrugata*. Orcutt[5] has described *diegoensis* as a variety of *corrugata*.

Haliotis lasia Woodring[6] described from the Miocene of the Temblor Range was stated to be similar to the Recent *H. fulgens* Philippi, while *H. palaea* Woodring[7] from the Modelo, upper Mio-

---

[3] *Haliotis kamtschatkana* Jonas, Zeitschr. f. Malakozool., November, 1845, p. 168. — Reeve, Conch. Icon., Vol. 3, *Haliotis*, April, 1846, sp. 8, pl. 3, fig. 8. "*Hab.* Oonalaska, near Kamtschatka, Northern Archipelago; Jonas." — Pilsbry, Manual Conch., Vol. 12, 1890, p. 85, pl. 9, figs. 47, 49. "Monterey, Cal. to Kamtschatka." (as [*H. gigantea*] var. *kamtschatkana* Jonas.) — Dall, U. S. Nat. Mus., Bull. 112, 1921, p. 184, pl. 19, figs. 1, 2. "Kamchatka Sea (Midd.) Sitka, Alaska, to Redondo, California, and Sendai, Japan." — I. S. Oldroyd, Stanford Univ. Publ. Univ. Ser. Geol. Sci., Vol. 2, pt. 3, 1927, p. 234, pl. 88, figs. 1 and 2. "Type locality, Unalaska Island, Kamchatka Sea." "Range. Kamchatka Sea, Sitka, Alaska, to Redondo, California, and Sendai, Japan."

[4] *Haliotis corrugata* Mawe, Linnaean Syst. Conch., 1823, p. 181. California. — Wood, Index Test., Suppl., 1828, p. 26, pl. 8, fig. 6 [No locality cited]. — Reeve, Conch. Icon., Vol. 3, *Haliotis*, 1846, sp. 12, pl. 4, fig. 12. "California." — Pilsbry, Manual Conch., Vol. 12, 1882, p. 80, pl. 5, fig. 24. "San Diego, Cal., southward; Catalina Island." — Grant & Gale, Mem. San Diego Soc. Nat. Hist., Vol. 1, 1931, p. 845. Earlier records cited. Also Pliocene.

[5] [*Haliotis corrugata*] var. *diegoensis* Orcutt, West Amer. Sci., Vol. 10, no. 5, (whole no. 88), March, 1900, p. 31. "near La Jolla," California. — Orcutt, West Amer. Sci., Vol. 21, no. 11, 1919. p. 88.

[6] *Haliotis lasia* Woodring, Proc. U. S. Nat. Mus., Vol. 81, Art. 15, August 30, 1932, p. 2, pl. 1, figs. 1, 2, 3, 4a, 4b. "Southwest edge of Temblor Range, adjoining Elkhorn Plain, San Luis Obispo County, Calif., NW. ¼ SW. ¼ sec. 6, T. 32 S., R. 22 E., about 200 yards up first western fork of canyon leading toward SW. cor. sec. 6, southwest of 2,800-foot hill between forks, R. Anderson and R. W. Pack, collectors, June 21, 1909 (U. S. Geol. Survey Loc. No. 12453); Santa Margarita (?) formation upper Miocene."

[7] *Haliotis palaea* Woodring, Jour. Paleon., Vol. 5, no. 1, March, 1931, p. 38, pl. 6, figs. 1, 1a, 2, 3. "South slope of Santa Monica Mountains, south end of ridge along east side of Brown Canyon, 1250 feet N. 3° W. from 756—B. M. along Los Angeles City Boundary, Sawtelle Quadrangle; H. D. Hobson, H. W. Hoots, R. D. Reed, and W. P. Woodring collectors (Calif. Tech. Loc. No. 52); base of Modelo formation (early upper Miocene)."

cene formation of southern California, was said to belong to the *H. corrugata* group. *H. palaea* has much stronger concentric ornamentation than *H. koticki* and the transverse, undulated ribs cross the spirals at more nearly right angles than they do in the new species. In this respect *H. koticki* resembles *H. assimilis* Dall[8] but the fossil species is apparently not close to *assimilis,* which has been reported from the Farallone Islands to San Diego, California.

Haliotis elsmerensis Vokes[9] has been described from the Pliocene of Elsmere canyon in southern California. It was considered to be closely related to the Recent *H. rufescens* Swainson.

This species is named for Mr. O. F. Kotick, geologist with the Tidewater-Associated Oil Company.

PLATE 42

Fig. 1. *Haliotis koticki* Hertlein, n. sp.; true height of figured specimen 99.6 mm.; holotype, No. 286 (Calif. Acad. Sci. Paleo. Type Coll.), from immediately below a bed of conglomerate 20 feet thick, 10,200 feet south 70½° west from Zaca Peak, and 13,600 feet east and 4,400 feet south of the northeast corner of La Zaca Rancho; central eastern part of Lompoc quadrangle, U. S. Geol. Surv. Topographic map, Santa Barbara County, California: upper Vaqueros, lower Miocene.

The apical portion of the specimen is incomplete.

Fig. 2. *Haliotis koticki* Hertlein, n. sp.; side view of specimen shown in figure 1.

Fig. 3. *Haliotis kamtschatkana* Jonas; true length of figured specimen 68.8 mm.; hypotype, No. 445 (Calif. Acad. Sci. Paleo Type Coll.), from Loc. 23263 (C. A. S.), Monterey, California; Recent: Carl Dolter, collector. Lateral view.

Fig. 4. *Haliotis kamtschatkana* Jonas; side view of specimen shown in figure 3.

---

[8] *Haliotis* (? var.) *assimilis* Dall, Proc. U. S. Nat. Mus., Vol. 1, 1878, p. 46. "Habitat. — Monterey; San Diego, Cal.; in deep water only; thrown up by heavy storms, usually dead and worn when found and everywhere rare. Mus. Cat. 31267." *H[aliotis]. assimilis* Dall, Pilsbry, Manual Conch., Vol. 12, 1890, p. 83, pl. 22, fig. 29. "Monterey and San Diego, Cal., in deep water." — Dall, U. S. Nat. Mus., Bull. 112, 1921, p. 184. "Farallones Islands to San Diego, California, in deep water."

[9] *Haliotis elsmerensis* Vokes, Jour. Paleon., Vol. 9, no. 3, April, 1935, p. 251, pl. 25, figs. 22, 23. "Elsmere Canyon, Los Angeles County, at the extreme northwest flank of the San Gabriel Range, just east of San Fernando Pass, in the NW. ¼ NW. ¼ SE. ¼ sec. 17, T. 3 N., R. 15 W., Mt. San Bernardino Base and Meridian; in the bed of the canyon about 15 feet downstream from the contact with the granite. The matrix is a coarse, almost pure quartz sandstone." "Lower Pliocene."

PLATE 42

A NEW GENUS OF LAGOMORPH FROM THE PLIOCENE OF MEXICO

By Robert W. Wilson

Among mammalian remains recently obtained in Pliocene deposits near Rincon, Chihuahua, Mexico, are materials of a new genus of lagomorph. Lagomorph types other than *Hypolagus* are rare in the later Tertiary of the New World, and the present record should be of interest to students of fossil leporids.

FAMILY LEPORIDAE

Notolagus velox, gen. et sp. nov.

Type Specimen—Left ramus with *I* and P_3-M_2, Calif. Inst. Tech. No. 2133.

Referred Specimens—Incomplete palate with left and right P^2-M^3, C. I. T. No. 2137; several fragmentary rami, C. I. T. Nos. 2134-36; and isolated teeth, C. I. T. Nos. 2138-40.

Geologic Age and Locality—Middle (?) Pliocene beds near Rincon, Chihuahua, Mexico.

Generic and Specific Characters—Dental formula: 2/1, 0/0, 3/2, 3/3. Upper incisors with simple, relatively narrow and deep groove which is filled with cement. P^2 with two rather narrow and deep anterior inflections of the enamel. P_3-M_2 with median inflections crenulated and extending approximately two- thirds of the distance across the occlusal surfaces of the teeth. P_3 with a postero-external inflection extending somewhat less than half-way across face of tooth; no postero-internal inflection; antero-internal inflection present and extremely deep and complexly folded, usually cutting completely across the tooth to unite with an antero-external inflection, thus isolating extreme anterior portion of tooth as a separate column. Size approximately as in *Hypolagus limnetus*.

Description

Superior Dentition—A right and a left first upper incisor, No. 2139, are referred to *Notolagus velox*. In cross-section these teeth are relatively narrow transversely. The wearing surface

has a rather long bevel, and, in the specimens available, lacks the pronounced bench usually present in the incisor. The anterior groove of the incisor is simple and rather narrow and deep. It is situated somewhat internal to the mid-point, and is filled with a deposit of cement.

The second upper incisors are also represented by two isolated teeth, No. 2140. These minute teeth are nearly circular in cross-section.

P^2 of No. 2137 (fig. 3) possesses two relatively deep and narrow anterior inflections. The internal fold is slightly the deeper of the two, and its inner margin is faintly crenulated.

The median enamel folds of P^3-M^2 extend two-thirds or more of the way across the occlusal surfaces of the teeth. They exhibit rather strongly crenulated anterior borders, but the posterior borders are only slightly folded. The degree of crenulation in M^2 is decidedly less than in the anterior teeth. M^3 is small and simple, and the wearing surface is of elliptical outline.

Inferior Dentition—The lower incisor is relatively narrow transversely, and the enamel face is very slightly concave. Posteriorly the tooth terminates beneath or slightly in back of the hinder part of P_3 and rather high in the ramus as in *Hypolagus,* instead of at the anterior margin of P_3 as in a number of Recent lagomorph specimens which are available for comparison.

The chief diagnostic characters of the new form lie in the pattern of P_3 (fig. 1a). This tooth is somewhat elongate in outline although the projecting lateral ribs make the antero-posterior and transverse measurements nearly equal. Specimen No. 2133, the type, has a P_3 composed of two distinct parts connected only by cement. The anterior half is much the smaller of the two, and is compressed antero-posteriorly to form an elliptical column. The enamel of the anterior border of this portion of the tooth is smooth, but the external border has two small inflections. The posterior half of P_3 has one external inflection of the enamel which extends less than half the distance across the wearing surface of the tooth. The posterior side of this fold is slightly crenulated. No postero-internal fold is present but the postero-internal border of the tooth is slightly concave. The anterior border of the posterior column of P_3 is strongly crenulate. The most constant feature of this crenulation is the presence of a deep, posteriorly-directed median plication. Specimens Nos. 2136 and 2135 in which P_3 is preserved, as well as an isolated left P_3, No. 2138, possess essentially the same pattern as that of P_3 in the type although crenulation may be intensified or reduced through individual variation. However, No.

2134, left and right rami with $P_{\bar{3}}$-$M_{\bar{1}}$, apparently pertaining to one individual, exhibits a noteworthy difference (fig. 2). In $P_{\bar{3}}$ of this specimen, the anterior column instead of being isolated completely from the posterior one, is connected with the latter by a narrow bridge of dentine near the external side of the tooth. Hence, this tooth exhibits a crenulated antero-external fold which is shallow and broad, and a deep and complexly folded antero-internal one of trefoil pattern. No. 2134 is slightly larger than the type but no larger than other specimens of *N. velox* with tooth patterns comparable to that in No. 2133. Since aside from the character mentioned, No. 2134 is identical in pattern with the type, the difference is believed to represent individual variation. It is possible that isolation of the anterior column of $P_{\bar{3}}$ is an expression of individual age differences. Since minor complications of folding in $P_{\bar{3}}$ are rather pronounced in No. 2134, and No. 2135 has a $P_{\bar{3}}$ with an isolated anterior column but with a relatively smooth enamel pattern, it is assumed tentatively that No. 2134 represents a young individual, and complete isolation of the anterior column occurs in a more adult stage. In any case, the pattern in No. 2134 parallels a necessary structural stage antecedent to that developed in the others.

Cheek-teeth $P_{\bar{4}}$-$M_{\bar{2}}$ do not present any very noteworthy features. The posterior borders of the external inflections are slightly crenulated. Transverse width of the posterior columns is about four-fifths that of the anterior ones. $M_{\bar{3}}$ is not represented in the collections.

Additional Remains—The rami and skull fragments which are available are too incomplete to require much comment. However, the material possesses features which suggest that with better preserved specimens of *Notolagus velox,* characters of value will be revealed by the skull and mandible. Thus, in the skull the anterior root of the zygomatic arch is relatively anterior in position in respect to the tooth-row: the depression of the angle below the inferior border of the horizontal ramus of No. 2136 is very marked.

Fragmentary specimens representing the appendicular skeleton and vertebral column are present but are too incomplete to permit comparisons.

Comparisons and Relationships

The mammalian fauna associated with *Notolagus velox* is nearest in affinities to the Hemphill fauna of Texas. The Hemphill assemblage is regarded by R. A. Stirton as of late middle Pliocene age.[1] Although the more southerly position of the Mex-

[1] R. A. Stirton: Amer. J. Sci., vol. 32, pp. 174-175, 1936.

ican fauna may introduce some measure of doubt as to its geologic age, it is certain that *N. velox* is of either middle or upper Pliocene age, and more probably the former. The sole genus of lagomorph recorded from the North American middle Pliocene is *Hypolagus.* Moreover, this genus and its close relatives are the only later Tertiary (exclusive of the upper Pliocene) leporids known from this continent. *Hypolagus* is also rather common in the upper Pliocene, but in addition relatively rare remains of true leporines and *Alilepus*(?) have been reported. These latter forms are presumably emigrants from outside the North American area. On the basis of the known history and geographic distribution of the Lagomorpha, it might be expected that *Notolagus* would show a closer relationship to *Hypolagus* than to any other known genus. If the views of L. R. Dice[2] on the fundamental importance of $P_{\overline{3}}$ are correct, such would seem to be the case.

Presence, in $P_{\overline{3}}$ of *Notolagus,* of a short postero-external inflection and absence of a corresponding inflection from the postero-internal side of the tooth ally this genus with *Hypolagus.* Likewise, these characters separate it from those forms with a deep external re-entrant (*Lepus, Oryctolagus, Sylvilagus* and other typical leporines), and from those with opposed postero-external and internal inflections (*Pronolagus, Romerolagus, Pentalagus*).

Except for more anterior portion of $P_{\overline{3}}$, the cheek-tooth characters of *Notolagus* can be duplicated in one or another of the various species of *Hypolagus.* However, the pattern developed in front of the postero-external inflection of the third premolar is so strikingly different as to justify the establishment of a distinct genus. In *Hypolagus* the entire front half of $P_{\overline{3}}$ is free of flexures except for a shallow antero-external fold. Since the genus *Hypolagus* is known in North America from the middle Miocene to lower Pleistocene, sufficient time is available for a transformation of $P_{\overline{3}}$ to the type seen in *Notolagus.*

Archaeolagus from the John Day and lower Miocene of the Great Plains has a $P_{\overline{3}}$ similar to that of *Hypolagus.* However, the dentition as a whole is decidedly more primitive than that of the latter genus, and the form is less related to *Notolagus.*

So far as I can determine, the isolation of the extreme anterior portion of $P_{\overline{3}}$ in *Notolagus* is unique among lagomorphs. *Prolagus* and *Piezodus,* European forms referred to the ochotonids, have third premolars with small but isolated anterior columns[3] but the resemblance ends with this character. Specimen

---

[2] See especially L. R. Dice: Jour. Mamm., vol. 10, no. 4, pp. 340-44, 1929.

[3] Jean Viret: Ann. Univ. Lyon, n. ser., 1, Sci., Med., Fasc. 47, p. 98, figs. 14a and e, 1929.

No. 2134 in which complete isolation of the anterior column does not occur, suggests that the separation is produced by a deep antero-internal fold which breaks across the dentine to join the short antero-external fold. The latter is comparable to the antero-external fold in $P^{\overline{3}}$ of *Hypolagus, Lepus* and other genera. Apparently, the antero- internal inflection is present only in the genera *Pentalagus, Caprolagus* and *Notolagus.* According to the taxonomy adopted by L. R. Dice, *Pentalagus* is a member of the Palaeolaginae, *Caprolagus* of the Leporinae, and *Notolagus* of the Archaeolaginae. *Pentalagus* is a Recent genus found only on the Liu Kiu islands, south of Japan. *Caprolagus* is also a living form inhabiting the foothill region of the Himalayas in northeastern India, southern China, and Formosa. Extinct species of this genus have been recorded from Europe and India. Apparently neither *Pentalagus* nor *Caprolagus* ever exhibit $P^{\overline{3}}$'s with an isolated anterior column.

Among the Recent Mexican lagomorphs is the unusual *Romerolagus,* of rather indeterminate affinities, found only on the slopes of some high mountain peaks, such as Popocatepetl. Apparently this genus is more closely related to *Pentalagus, Pronolagus* (South Africa) *and Alilepus* (Asia, Europe and North America?) than to *Notolagus.*[4] However, the form is mentioned since it suggests that stocks are present in Mexico which may not be related to either the later Tertiary "Archaeolaginae" or to the modern "Leporinae."

Conclusions: *Notolagus,* a new genus of lagomorph from the Pliocene of Mexico, is regarded tentatively as representing a derivative of *Hypolagus.* The geologic time range of *Hypolagus* is in accord with this hypothesis. The Mexican type adds to the list of lagomorphs which have a $P^{\overline{3}}$ with short postero-external inflection and no corresponding internal inflection, and hence may strengthen Dice's view that forms with such characters represent a distinct group which he has termed the Archaeologinae.

---

[4] M. W. Lyon, Jr.: Smithsonian Misc. Coll., Quarterly Issue, vol. 1, pp. 424-25, 1904.
L. R. Dice: *op. cit.*, pp. 340-43, 1929.
C. L. Gazin: Proc. U. S. Nat. Mus., vol. 83, no. 2976, p. 120, 1934.

MEASUREMENTS (in millimeters) OF *Notolagus velox*.

	Left maxillary, $P^{\underline{2}}$-$M^{\underline{3}}$ No. 2137	$I^{\underline{1}}$, No. 2139
$I^{\underline{1}}$, antero-posterior diameter	..	2.1
$I^{\underline{1}}$, transverse diameter	..	2.3
Occlusal length, $P^{\underline{2}}$-$M^{\underline{3}}$	11.7	..
Alveolar length, $P^{\underline{2}}$-$M^{\underline{3}}$	13.4 (e)	..
$P^{\underline{2}}$, antero-posterior diameter*	1.4	..
$P^{\underline{2}}$, transverse diameter	2.8	..
$P^{\underline{3}}$, antero-posterior diameter	2.0	..
$P^{\underline{3}}$, transverse diameter	4.3	..
$P^{\underline{4}}$, antero-posterior diameter	2.0	..
$P^{\underline{4}}$, transverse diameter	4.1	..
$M^{\underline{1}}$, antero-posterior diameter	1.9	..
$M^{\underline{1}}$, transverse diameter	3.8	..
$M^{\underline{2}}$, antero-posterior diameter	1.9	..
$M^{\underline{2}}$, transverse diameter	3.5	..
$M^{\underline{3}}$, antero-posterior diameter	0.9	..
$M^{\underline{3}}$, transverse diameter	1.5	..

	Left ramus, $P^{\overline{3}}$-$M^{\overline{2}}$ No. 2133 (type)
Depth of ramus below $M^{\overline{1}}$	11.7
Thickness of ramus below $M^{\overline{1}}$	4.3
Length of diastema, *I*-$P^{\overline{3}}$	13.8
Length of $P^{\overline{3}}$-$M^{\overline{2}}$ (occlusal surface)	9.3
Length of $P^{\overline{3}}$-$M^{\overline{2}}$ (alveolar)	10.2
I, antero-posterior diameter	2.0
I, transverse diameter	2.1
$P^{\overline{3}}$, antero-posterior diameter*	2.6
$P^{\overline{3}}$, transverse diameter	2.6?
$P^{\overline{4}}$, antero-posterior diameter	2.2
$P^{\overline{4}}$, transverse diameter	2.8
$M^{\overline{1}}$, antero-posterior diameter	2.2
$M^{\overline{1}}$, transverse diameter	2.5
$M^{\overline{2}}$, antero-posterior diameter	2.2
$M^{\overline{2}}$, transverse diameter	2.5

* Measured at occlusal surface.
(e) Estimated.

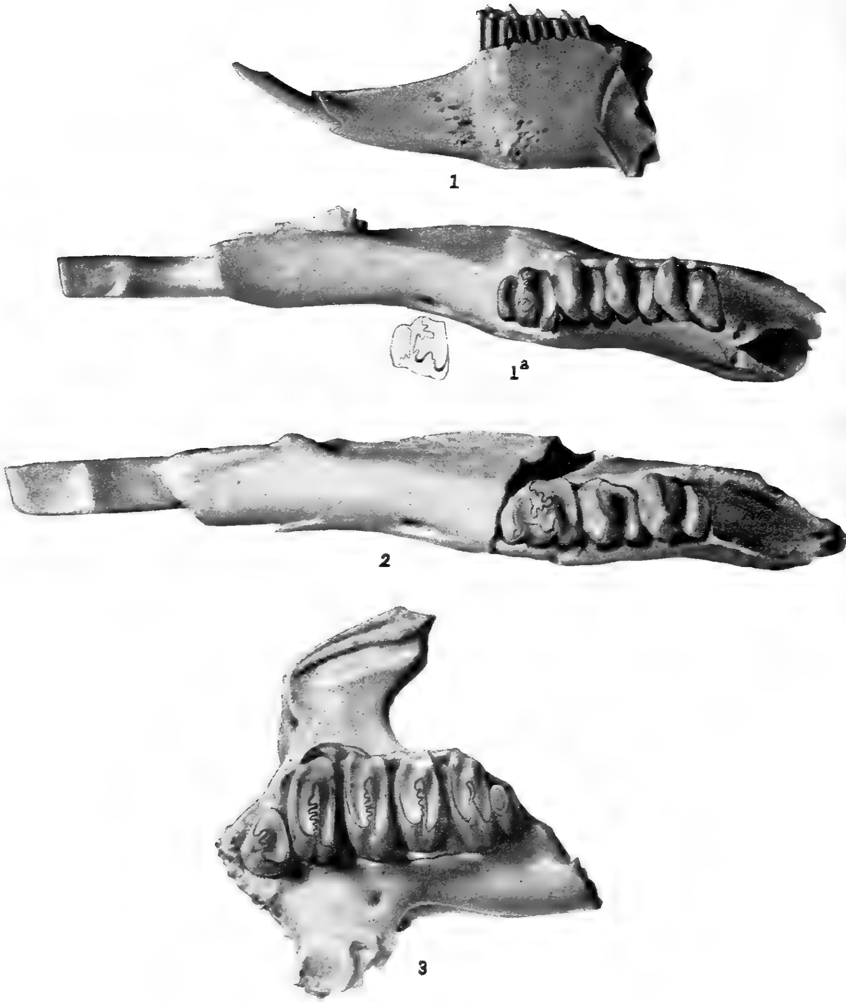


PLATE 43

NOTOLAGUS VELOX, GEN. ET SPEC. NOV.

Figures 1, 1a. Type specimen, left ramus with *I* and $P_{\overline{3}}$ - $M_{\overline{2}}$, No. 2133. Fig. 1, external view, X1½; fig. 1a, occlusal view, X3.

Figure 2. Left ramus with *I* and $P_{\overline{3}}$ - $M_{\overline{1}}$, No. 2134. Occlusal view, X3.

Figure 3. Left maxillary with $P^{\underline{2}}$ - $M^{\underline{3}}$, No. 2137. Occlusal view, X3.

Size of figures approximate; enlargement not exactly to same scale.

Calif. Inst. Tech. Coll. Pliocene: Rincon, Chihuahua, Mexico.

REPORT ON PLEISTOCENE MOLLUSCAN FAUNA AT CAPISTRANO BEACH, ORANGE COUNTY, CALIF.

By G. Willett

A few months ago Mr. Don W. Leyden, of Doheny Park, Calif., reported to the Los Angeles Museum that numerous fossil invertebrates had been exposed during grading work on a real estate subdivision at Capistrano Beach, Orange County, Calif. In order to obtain information on the character of this exposure, the writer and his wife, accompanied by Mr. Leyden, visited the locality on September 20-21, 1937. It was found to be approximately one-half mile back from the present beach, at an altitude of about 150 feet. The fossiliferous vein, a foot or more in depth, was on the slope of a hill and covered by 10 to 12 inches of clay. Below the vein was brown sand of an undetermined depth.

We occupied the larger part of two days excavating and screening and brought back about 400 pounds of screenings, which were sorted at the museum. From this material nearly 5,000 specimens of mollusks, of 153 species, were preserved.

A study of the species indicates a shallow water assemblage, probably of less than 5 fathoms. That the water was colder than it is in the same region today appears to be demonstrated by the occurrence of such species as Cardium corbis (Mart), Pseudomelatoma torosa (Cpr.), Olivella pedroana (Conr.), Tritonalia subangulata (Stearns), Bittium ornatissimum Bartsch, and Diadora aspera (Esch.). To find these species in shallow water at the present time, it would be necessary to go north to some point between Point Conception and Monterey. Considering this, it would appear that the Capistrano Beach deposit is referable to the Lower San Pedro series of the Pleistocene.

As this locality has not been reported on previously, the identified species are listed below, the most abundant being marked with an asterisk.

*Leda taphria Dall.
Yoldia cooperi Gabb.
Philobrya setosa (Cpr.).
*Ostrea lurida Cpr.
Pecten hindsi Cpr.
Pecten hericeus Gld.
*Pecten latiauritus Conr.
Septifer bifurcatus (Conr.).
Modiolus modiolus (Lin.).
*Glans carpenteri Lamy.
*Lucina nuttallii Conr.
Lucina californica Conr.
Taras orbellus (Gld.).
Rochefortia tumida (Cpr.).
Rochefortia aleutica (Dall).
Chironia subauricularis (Mont.).
Cardium substriatum Conr.
Cardium quadragenarium Conr.
Cardium corbis (Mart.).
*Venerupis tenerrima (Cpr.).

Venerupic staminea (Conr.).
*Transenella tantilla (Gld.).
Tivela stultorum (Mawe).
*Petricola carditoides (Conr.).
Tellina bodegensis Hds.
Tellina buttoni Dall.
*Macoma inquinata Desh.
Macoma indentata Cpr.
Macoma cf. quadrana Dall.
Semele rubropicta Dall.
Cumingia lamellosa Sby.
*Donax gouldi Dall.
Solen sicarius Gld.
Ensis californicus Dall.
Siliqua lucida (Conr.).
*Platyodon cancellatus (Conr.).
Schizothaerus nuttallii (Conr.).
Cryptomya californica (Conr.).
Zirfaea pilsbryi Lowe.
Pholadidea penita (Conr.).
Pholadidea parva Tryon.
Dentalium pretiosum Sby.
*Dentalium neohexagonum S. and P.
Acteon punctocaelatus (Cpr.).
Retusa harpa Desh.
Retusa culcitella (Gld.).
Conus californicus Hds.
Moniliopsis incisa (Cpr.).
Pseudomelatoma torosa (Cpr.).
Clavus hemphilli (Sts.).
Mangelia merita (Hds.).
Mangelia interlirata (Sts.).
*Mangelia variegata Cpr.
Mangelia aspera (Cpr.).
Clathurella conradiana Gabb.
*Olivella biplicata (Sby.).
*Olivella pedroana (Conr.).
Hyalina jewettii (Cpr.).
Hyalina subtrigona (Cpr.).
Cypraeolina pyriformis (Cpr.).
Fusinus arnoldi Cossman.
Nassa cooperi Fbs.
Nassa fossata Gld.
Nassa perpinguis Hds.
*Columbella carinata Hds.
Columbella tuberosa Cpr.
Amphissa versicolor Dall.
Tritonalia cf. squamulifera (Cpr.).
Tritonalia subangulata (Sts.).
Tritonalia interfossa (Cpr.).
*Acanthina spirata (Blain.).
Erato vitellina Hds.
Bittium catalinensis Bartsch.
*Bittium rugatum Cpr.
Bittium interfossum Cpr.
Bittium attenuatum Cpr.
*Bittium ornatissimum Bartsch.
*Seila montereyensis Bartsch.
Cerithiopsis antemunda Bartsch.
Cerithiopsis pedroana Bartsch.
Cerithiopsis antefilosa Bartsch.
*Cerithiopsis cosmia Bartsch.
Metaxia diadema Bartsch.
*Triphora pedroana Bartsch.
Rissoina kelseyi Dall.
Turritella cooperi Cpr.
Aletes squamigerus Cpr.
Petaloconchus complicatus Dall.
Micranellum crebricinctum (Cpr.).
Fartulum occidentale Bartsch.
Littorina scutulata Gld.
Lacuna unifasciata Cpr.
*Lacuna marmorata Dall.
Hipponix tumens Cpr.
Hipponix antiquatus (Lin.).
Crepidula onyx Sby.
Crepidula excavata (Brod.).
*Crepidula lingulata Gld.
Crepidula nummaria Gld.
Polinices lewisii (Gld.).
Polinices reclusianus altus Dall.
Acmaea cf. cassis Esch.
Acmaea paleacea Gld.
Acmaea insessa (Hds.).
*Phasianella pulloides Cpr.
Leptothyra carpenteri Pils.

Leptothyra paucicostata Dall.
Halistylus pupoideus (Cpr.).
Tegula gallina (Fbs.).
Tegula montereyi (Kiener).
*Calliostoma canaliculatum (Mart.).
Calliostoma costatum (Mart.).
Calliostoma tricolor Gabb.
Calliostoma supragranosum Cpr.
Calliostoma annulatum Mart.
Margarites parcipictus Cpr.
Vitrinella stearnsi Bartsch.
Fissurella volcano Rve.
*Diadora aspera (Esch.).
Diadora murina (Dall).
*Megatebennus bimaculatus Dall.
Opalia evicta DeB.
*Epitonium tinctum (Cpr.).
Melanella micans (Cpr.).
*Melanella thersites (Cpr.).
Turbonilla attrita D. and B.
Turbonilla asser D. and B.
Turbonilla pecora T. S. Oldroyd.
Turbonilla stylina Cpr.
Turbonilla cf. berryi D. and B.
Turbonilla lowei D. and B.
*Turbonilla halistrepta D. and B.
Turbonilla valdezi D. and B.
Turbonilla chocolata Cpr.
Turbonilla halia D. and B.
Turbonilla almo D. and B.
Turbonilla tridentata (Cpr.).
Odostomia turricula D. and B.
Odostomia cf. nota D. and B.
*Odostomia donilla D. and B.
Oldroydia percrassa Dall.
Nuttallina californica (Rve.).
Ischnochiton magdalenensis (Hds.).
Ischnochiton radians Cpr.
*Ischnochiton decipiens Cpr.
Chaetopleura gemmea Cpr.
*Callistochiton palmulatus Cpr.
*Callistochiton crassicostatus Pils.
Mopalia muscosa (Gld.).
Mopalia lignosa (Gld.).
Mopalia ciliata (Sby.).
Placiphorella velata Cpr.
Gyraulus vermicularis (Gld.).

BEES COLLECTED BY MR. AND MRS. J. L. SPERRY AND MR. R. H. ANDREWS IN ARIZONA

By T. D. A. Cockerell

ANTHOPHORIDAE

Clisodon terminalis sperryi n. subsp.

Male more robust, with the long hair of face and upper part of thorax bright reddish-fulvous, the thorax above with only a few inconspicuous dark hairs on disc; abdominal hair-bands

broader, somewhat fulvescent, the fifth tergite with thin inconspicuous black hair at base, but a broad apical pale band, apex with pale hair, but black at base of sixth tergite; hind tibiae very stout; a widely separated very conspicuous spot of pale fulvous hair at extreme base of sixth ventral segment. The eyes are very dark brown.

Arizona: Alpine, June 4, 1937 (Grace H. and John L. Sperry).

Perhaps a distinct species, but more material is needed.

Anthophora simillima Cresson: females from Alpine and Turkey Creek.

A. smithii Cresson: males from Wildcat Creek and Alpine.

A. texana Cresson: female from Alpine (Sperry).

Diadasia diminuta Cresson: one of each sex. Alpine (Andrews).

Melissodes tristis Cockerell: male, Alpine (Andrews).

BOMBIDAE

Bombus morrisoni Cresson: Turkey Creek, White Mountains (Sperry); Alpine (Andrews).

B. dorsalis Cresson: Turkey Creek and Alpine. Many specimens.

B. centralis monardae Cockerell and Porter. Turkey Creek and Wildcat Creek, White Mountains (Sperry); Alpine (Andrews).

MEGACHILIDAE

Lithurgus apicalis opuntiae Cockerell. Both sexes. Baboquivari Mountains, May 22 (Sperry).

Lithurgus arizonensis n. sp.

Female: Length about 16 mm., anterior wing 9.4; wings brownish hyaline. This was collected at the same time and place as *L. apicalis opuntiae,* and was at first assumed to be the same, but it clearly differs by the following characters: Disc of clypeus flat, with widely scattered very large punctures, on each side of the flat area the clypeus rapidly slopes downward to the margin; a few hairs, but no strong beard over lower margin of clypeus; the part of labrum exposed below clypeus appearing strongly notched in middle; the bilobed facial prominence very large, the lobes distant and obtuse with large punctures, the interval broadly angular (V-like, but much wider); metathorax behind lacking the strong upwardly-directed tuft of hair; marginal cell rather

longer and more pointed, appendiculate at end; hair at end of abdomen dark reddish-brown, paler at extreme apex. The flagellum is ferriginous beneath.

Arizona: Baboquivari Mountains, May 22, 1937 (Grace H. and John L. Sperry).

The following key separates the related females:

Facial prominence not bilobed; hair at end of abdomen rusty black .... *gibbosus* Smith

Facial prominence bilobed 1

1. Hair at end of abdomen bright ferruginous .... *apicalis* Cresson

   Hair at end of abdomen dark 2

2. Clypeal lobes directed downward, the broad interval between them very shallow; flagellum obscurely reddish brown beneath .... *bruesi* Mitchell

   Clypeal lobes directed upward and outward 3

3. Clypeus very smooth in middle, not flattened .... *opuntiae* Cockerell

   Clypeus flattened in middle, with large punctures; interval between the facial lobes much deeper .... *arizonensis* n. sp.

Megachile vidua Smith. Males. Turkey Creek and Alpine (Sperry).

Osmia armaticeps Cresson. Female. Wildcat Creek (Sperry).

O. olivacea Cockerell. Females. Wildcat Creek (Sperry).

Osmia lyncis n. sp.

Female length about 11 mm., anterior wing 7.5, width of abdomen about 4 mm.; head and thorax dark blue-green, with the lower half of clypeus black; the mesothorax dull and granular, practically black, except posteriorly where it is shining

green and strongly punctured; antennae, legs and tegulae black; wings brownish; hair of face and front black, long and coarse, very long on front; vertex with thin black hair; thorax above, and sides of metathorax, with long white hair; mesopleura with black hair, but long white hair on tubercles. Clypeus convex, shining between the strong punctures, the apical margin in middle produced, smooth, subtruncate, appearing shallowly emarginate under the microscope but seen with a lens appearing distinctly binodose, with a depression between the prominent tubercles, but no trace of a median denticle (the structure in *O. nelsoni* is practically the same); mandibles elongate, tridentate (not counting inner corner), with a very strong outer groove; scutellum green, shining between the punctures; area of metathrox black, entirely dull, contrasting with the dark green on each side; mesopleura very dark blue, dull and densely punctured; basal nervure meeting nervulus; first recurrent nervure ending nearly as far from base of second cubital cell as length of intercubitus; legs with black hair, abdomen broad and convex, shining blue-green, strongly punctured; first tergite with long white hair, the others with short black hair; ventral scopa black.

Arizona: Wildcat Creek, White Mountains, June 12, 1937 (Grace H. and John L. Sperry). I was at first disposed to consider this a variety of *O. nelsoni* Cockerell, but it is evidently distinct, being much more robust with a much larger head, and the abdomen much more strongly punctured.

Anthidium maculosum Cresson. Females. Wildcat Creek (Sperry).

Stelis montana Cresson. Two from Wildcat Creek, June 12 (Sperry).

HALICTIDAE

Agapostemon texanus Cresson. Eleven females from Alpine and two from Wildcat Creek.

Halictus trizonatus Cresson. Nine females from Alpine, four from Wildcat Creek, one from Turkey Creek, one from Greer.

There are also species of *Sphecodes* and *Colletes* which are best put aside until the southwestern members of these genera can be revised. Mr. Timberlake has many undescribed species of both genera.

MISCELLANEOUS NOTES ON WESTERN LEPIDOPTERA

By John A. Comstock

Scepsis fulvicollis Hbn. The larva of this species was briefly described by Coquillett,[1] and Dyar, in 1900 records a very complete anlaysis of the life history.[2] The moth is of common occurrence in the eastern states, but it is not so generally known that it is found in the Sierras of California.

PLATE 44

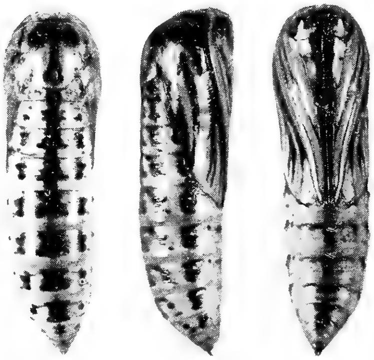
Larva of *Scepsis fulvicollis* Hbn., last instar, enlarged x 3.

[1] Canad. Entom., vol. 12, p. 44, 1880, and Trans. Dept. Agr. Ill., vol. 18, ap., p. 171.

[2] Proc. U. S. Nat'l. Mus. XXIII, p. 264.

In late July of 1936, Mr. Lloyd Martin brought in a considerable quantity of larvae, collected in the Big Meadows, north of Mono Lake. These gave forth imagines in early August of the same year. The duration in pupa averaged about six days.

In view of the fact that no illustrations of larva or pupa of this species have been published to our knowledge, we are including reproductions of photographs on Plates 44 and 45.



a. *b.* *c.*

PLATE 45

Pupa of *Scepsis fulvicollis* Hbn., enlarged x 3.
a. Dorsal aspect. *b.* Lateral aspect.
c. Ventral aspect.

Pterotaea melanocarpa Swett. This species was described by Swett in the "Lepidopterist," vol. 1, p. 5, 1916. The holotype was taken at "Boulevard," Calif., wherever that may be. Since it was captured by G. H. Field, we suspect it is somewhere in San Diego County.

The paratype was from Julian, which is in the Cuyamaca Mountains, San Diego County. In December of the same year Barnes and McDunnough described *Pterotaea tremularia*[3] from Camp Baldy in the San Bernardino Mountains, Calif., which proved to be a synonym of *melanocarpa*. We have the species in considerable numbers from the Bouquet Canyon area in Los Angeles County, and have bred the larva on *Quercus*.

The imago is figured in the B. & McD. Contributions, vol. 111, (1), plate 11, fig. 4. This example is somewhat more heavily marked through the discal area of primaries than is the average, if we may judge from the illustration.

---

[3] Cont. Nat. Hist. Lep. N. Am. 111, (1) 27.

Mature larva: Cylindrical; length, 30 mm. In form it is of the usual "looper" type, with a single pair of prolegs and a pair of anal prolegs.

The body color is olive-brown, on which is superimposed numerous longitudinal cream colored wavy discontinuous lines, edged with darker brown.

Two short papilliform processes arise near the caudal end, each bearing a seta. A few short straw colored setae are scattered over the body, each one arising from a small dark papillus. These features are well brought out in the accompanying cut, Plate 46.

Spiracles, cream colored, edged with dark brown circlets and surrounded by a soiled white area. Legs and prolegs spotted; concolorous with body. Abdomen, white, with numerous longitudinal dark brown broken wavy lines.

Head, mottled cream and red-brown.

PLATE 46

Mature larva of *Pterotaea melanocarpa* Swett, on oak leaf, enlarged x 3.

Pupation occurred on the floor of the breeding cage, in a loosely constructed semblance of a cocoon, in which the ground litter was incorporated.

Pupa: Length, 13 mm. Texture of surface, smooth. Color, blackish brown. No tubercles or setae occur on the surface. The cremasteric end is formed of two tapering spinous processes without hooked ends.

Larvae collected in May gave forth imagines from the middle to the end of June of the same year.

Aethaloida packardaria Hlst. This interesting species, formerly placed in the Genus *Hulstina* is illustrated on Plate VII, fig. 11 in Dr. McDunnough's excellent "Studies in North American Cleorini (Geometridae)," Bulletin No. 18, Department of Agriculture, Ottawa. No description or illustration of the larva occurs in the literature, to my knowledge.

In June of the present year (1937) while beating for larvae in upper Bouquet Canyon, Los Angeles County, some very interesting stick-like caterpillars were taken on *Ceanothus,* and also on *Adenostoma.* A few were raised to maturity and proved to be the above species.

A large number of geometrid larvae resemble twigs, in shape, coloration and posture, but no better example of this type of adaptation has thus far come to my knowledge. The mature larva may be described as follows:

Length, 36 mm. Color, uniform slaty gray. Cylindrical, with numerous roughened proturberances and processes.

The first two pair of legs are held close to the body. The third pair are long, and are held at right angle to the long axis of the body in such a manner as to suggest a bud or beginning of a twig.

On the fifth and seventh segments are two tubular branch-like processes (one each side of mid-dorsal area) tipped with setae.

On the sixth segment in the abdominal area is a prominent ridge, topped with six warty processes, each bearing a seta.

On the caudal segments are two short processes, one each side of the median line, each tipped with a seta.

At various other areas on the body are low warty nodules (well defined in the accompanying illustration, Plate 47) which further heighten the resemblance of this larva to a twig.

Legs and prolegs concolorous with body. Spiracles gray, heavily rimmed with black. Numerous setae arise from small gray nodules at various points on the body surface.

Head: The lobes are protruded forward and slightly upward into two sub-pyramidal crests, which are concolorous with body but spotted with black. Ocelli, black.

The larva spins a loosely woven cocoon. This may be on the foodplant or among the debris on the ground.

PLATE 47

Mature larva of *Aethaloida packardaria* Hlst., resting on twig of *Ceanothus*. Enlarged approximately x 2.

The species ranges from southern California northward to Oregon, or perhaps beyond. We have examples from Flagstaff, and from the White Mountains, Arizona. It is not unlikely that three broods occur in a year, as our series records captures in February, June, July and December.

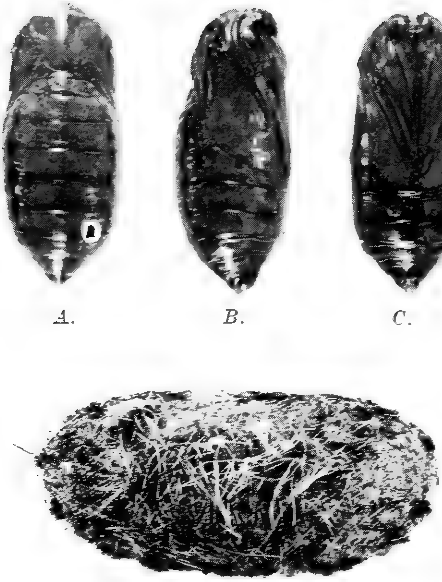
Dr. McDunnough lists *Selidosema lachrymosa* Hlst., and *Selidosema homopteroides* Hlst., as synonyms of *Aethaloida packardaria* Hlst.

Halisidota ingens Hy. Edw. of which Stretch's *scapularis* is a synonym, ranges through Arizona into New Mexico and, according to Neumoegen and Dyar[4] into the Rocky Mountain region.

A single larva of this species was picked up by the writer in mid July of 1935, on the Greer Road, White Mountains, Arizona.

This specimen began to spin a cocoon immediately, and the notes that were made of it at the time were necessarily somewhat sketchy.

[4] Journ. N. Y. Ent. Soc. III, 172, 1893.



A. *B.* *C.*

D.

PLATE 48

Pupa and cocoon of *Halisidota ingens* Hy. Edw. enlarged approximately x 2.

A. Pupa, dorsal aspect. *B.* Pupa, lateral aspect.

C. Pupa, ventral aspect. *D.* Cocoon.

In late June of 1937, Mr. Robert H. Andrews secured a few larva, some of which were found on iris. This may be the food-plant of the species, although none of the larvae was observed to feed.

All had begun to spin before they reached our laboratory.

Three examples emerged July 5, 1937. The larvae were secured near Alpine, White Mountains, Arizona.

Mature larva: Thickly covered with hair of varying colors and lengths. There are several tufts of thick, short brick-red hairs on the median portion of thoracic area; also several long bundles of black hairs toward the front and anal areas. A thick covering of mixed grayish - white and black hairs occurs over the body.

The cocoon is compactly and evenly woven, and may be recognized by the mixture of body hairs that are incorporated in it. This is illustrated in the lower figure on Plate 48. This same

plate also shows the pupa. For purposes of comparison we also illustrate the cocoon and pupa of *Halisidota maculata agassizi* Pack., on Plates 50 and 51. It will be noted that the pupa of *H. ingens* is considerably more contracted throughout the thoracic area.

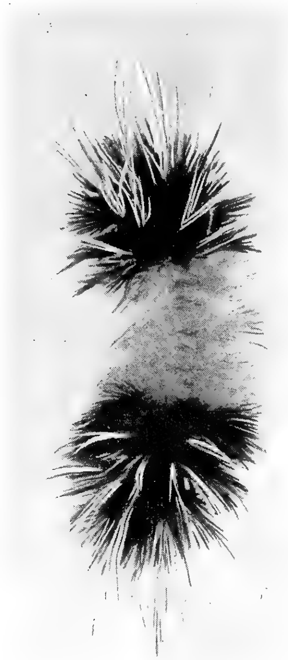
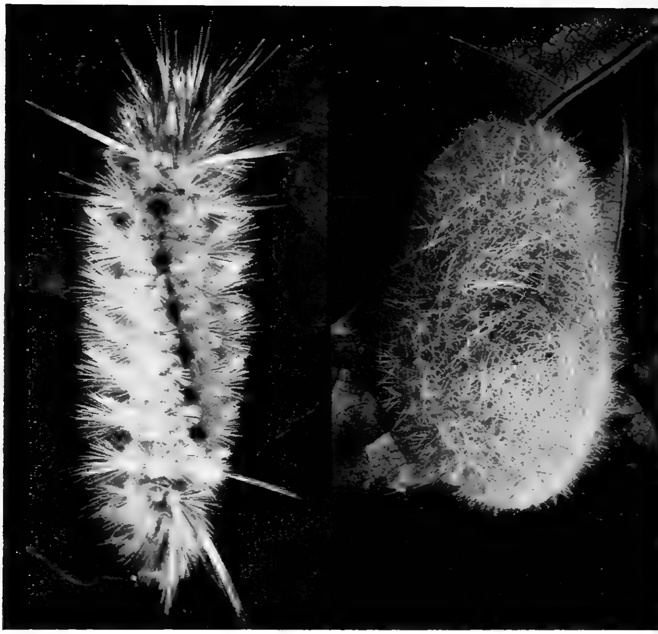


PLATE 49

Typical larva of *Halisidota maculata agassizi Pack.*, enlarged x 2.

With regard to *Halisidota maculata agassizi*, Dyar has already remarked on the extreme variability of the larva.[5] The common type found in the region of Los Angeles has the anterior four segments and the posterior three or four predominantly black, with an interposed yellow area. The long pencils, anteriorly and posteriorly, are white, and the short mid-dorsal tufts black.

[5] Psyche, VI, p. 324, 1892.



A. *B.*

PLATE 50

Larva and cocoon of *Halisidota maculata agassizi* Pack.

A. Mature larva, of unusual white form, dorsal aspect.

B. Cocoon, showing inclusion of white hairs.

All figures enlarged approximately x 2.

Our illustration, Plate 50, shows a variety which is not mentioned by Dyar, in which practically all of the hairs are white, the only exception being the much reduced mid-dorsal tufts of black. The common type of larva is shown on Plate 49.

The pupa of *H. maculata agassizi* is a rich chestnut red, and the average length is 20 mm.

Foodplants: willow, poplar and alder.

Halisidota argentata subalpina French. Mr. R. H. Andrews also secured a number of larvae of this subspecies, near Williams, Arizona, not far from the Grand Canyon. These were feeding on Juniper.

a. *b.* *c.*

PLATE 51

Pupa of *Halisidota maculata agassizi* Pack.
enlarged approximately x 1½.

a. Dorsal aspect. *b.* Lateral aspect. *c.* Ventral aspect.

We compared these with Henry Edward's description of the larva of *H. argentata*[6] and found that in practically all particulars they were the same. Dr. Dyar states that the larva is unknown[7] but remarks on the similarity of the mature insect to *H. argentata.*

We illustrate the mature larva on Plate 52.

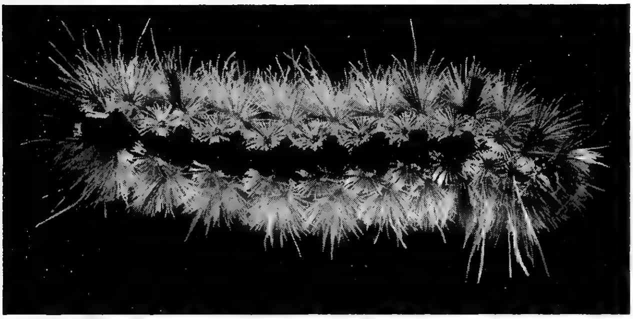


PLATE 52

Mature larva of *Halisidota argentata subalpina* French,
shown in dorsal aspect, enlarged.

---

[6] Proc. Calif. Academy of Sci., Sept. 1874.

[7] Can. Entom., vol. 24, p. 305, 19, 1892.

Gnophaela clappiana Holl. This species was first described by Dr. Holland[8] from the mountains of Williams River, Colorado. It is evidently somewhat more common, though never abundant in the mountains of Arizona.

While collecting along the Greer Road, White Mountains, Arizona, in 1935, a highly colored larva was found on my butterfly net. An effort was made to feed it on several local plants, but without avail. The specimen was apparently in about the penultimate instar. It was successfully photographed, and a brief description drawn up for future reference. The caterpillar was collected June 26, and lived until July 8 without moulting.

In the summer of 1937, Mr. Robert H. Andrews brought us a second larva from Williams, Arizona. It was fully matured, and had started to spin a cocoon. This example emerged on July 1, 1937.

Mr. Andrews was unable to definitely name the plant on which the larva was taken.

Larva, probably in penultimate instar.

Head, shining dark maroon, the sutures slightly lighter. Ocelli tinged with black. Mouth parts edged with black. There are a few short black hairs scattered over the head.

Body: In the mid-dorsal line there is a row of bright yellow triangles, placed longitudinally, their tips conjoined, and their bases resting on the segmental junctures. Lateral to this is a row of large warty double tubercles of a glistening steel-blue color, each one topped with a tuft of moderately long hairs. The majority of these hairs are black, but a few are light straw. Between these tubercles is a patch of velvety dull black, which, with the tubercles gives the appearance of a wide longitudinal black band. Latero-inferior to this is a narrow bright yellow line, interrupted with black below each tubercle.

PLATE 53

Larva of *Gnophaela clappiana* Holland, lateral view, enlarged.

[8] Ent. News, II, 156, 1891.

Inferior thereto is another line of single large steel-blue tubercles, tufted similarly to those of the first line. Below this is a wide band of yellow formed by a series of triangles with their apices on each segmental juncture. Below this is a third line of slightly smaller steel-blue tubercles, similar to the others.

Legs black; prolegs and anal prolegs black at the base, maroon on the distal third, with black claspers.

Abdomen striped with yellow. Plate 53 illustrates the larva.

A loosely woven cocoon was formed.

Pupa: Length, 20 mm. The predominant color is a shining black, with several rows of more or less irregular yellow spots disposed as shown on the accompanying illustration, Plate 54.

One of the most characteristic features of this chrysalis is the bundle of hooklets placed at the cremasteric end, and also the several small bundles of similar hooks on the anterior end of the thorax and head, thus serving to give a double anchorage in the cocoon.

The chrysalis turned a solid black just before emergence of the imago.

a. *b.* *c.*

PLATE 54

Pupa of *Gnophaela clappiana Holland*, enlarged x 2.
a. Lateral aspect. *b.* Dorsal aspect. *c.* Ventral aspect.

Oidaematophora longifrons Wlshm. Larvae of this species were found on *Perezia microcephala* (D. C.) Gray. They were fairly abundant in the upper Cajon Pass, San Bernardino County, on June 14, 1937.

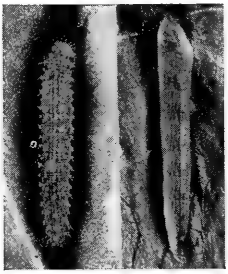
Mature larva: Length 12 mm.

The body is predominantly light green, and bears several

narrow longitudinal white lines, alternating with rows of raised nodules which are topped by short white bristles. Some of the latter have a small black tip at the point of junction of the bristle with the nodule.

The median white line is the most clearly defined. The row of nodules occuring along the infrastigmatal fold bears a greater number of bristles than any of the others. This larva is illustrated on Plate 55, fig. *A*.

Pupation occurs on the leaf of foodplant, the pupa being actually longer than the mature larva.



A. *B*.

PLATE 55

Larva (*A*) and pupa (*B*) of *Oidaematophora longifrons* Wlshm. enlarged approximately x 2½.

Pupa: Length, averaging about 14 mm. Color, at first a clear green, changing later to wood brown with darker markings. The anterior end is rather acutely pointed; posterior end gradually tapering. Fine longitudinal pencilings, suggestive of the light lines of the larva are usually present, or at least faintly indicated. Plate 55, fig. *B* illustrates the pupa.

On the same species of plant there were found quantities of the larvae of *Choreutis gemmalis* Hlst. This larva eats away the green parenchyma and one layer of the epidermis of the leaf, leaving only a thin transparent membrane. It particularly seems partial to the central portions of the leaf. A fine network of webbing is spun, which includes a tunnel-like structure, running parallel with the midrib. In this tunnel the larva pupates. When it is about ready for emergence the pupa pushes forward to the end of the tunnel and its fore-portion is extruded, so that the moth will be free to exit without having to traverse any of the tunnel.

It is easy to note a plant of *Perezia* which is infested with the above larvae, as it has a seared and curled appearance.

The imago has a rather weak flight. When it is at rest, the wings are held in a peculiar arched or semi-folded manner which gives the appearance of the moth having freshly emerged, and the wings having only partially expanded.

For determinations on the above two species of moths we are indebted to Dr. August Busck of the National Museum.

An ichneumon of the genus *Epitomus* was bred from *Choreutis gemmalis*.

A NEW FORM OF *Hesperumia sulphuraria* Pack. This common and well known moth was first described by Packard[9] from examples taken in Maine, and was later described by the same author as *ochreata* from Californian examples. In his Monograph of the Geometrid Moths, Packard acknowledges the synonymy of *ochreata* and reproduces a figure on Plate XI, fig. 47. This figure, together with his description on p. 477 of the same work shows the typical form to be that with the "very large orbicular brown discal ring" and the two incomplete lines or rows of spots crossing the wing from the costa to the hind margin, one of these rows being internal and the other external to the discal ring.

Hulst, in 1880[10] described *Rumia baltearia* which is that form in which there is on the fore wings "a broad band of brown occupying one-fourth their area in length; this is angulated outwardly on its inner margin, and waved outwardly and irregularly on its outer margin. It extends at an almost uniform width half way across the wings, then suddenly becomes reduced in width, and thus extends to posterior margin." His types were from Minnesota and Colorado.

The same author described, in 1886,[11] still another form, "*Rumia ochrearia* var. *unicoloraria*" which "differs from the type form in being of a clear bright yellow, without any markings whatsoever."

All of the above forms, with their intergrades, occur in California, and in addition there is an extreme variation to which no published description can possibly apply. I have bred this form along with all the other named varieties from *Ceanothus, Adenostoma* and *Cercocarpus*. Dr. McDunnough, to whom I submitted specimens, has kindly suggested that I give it a name. Accordingly I propose:

Hesperumia sulphuraria f. **fumosaria** f. nov.

Same size and shape as typical *sulphuraria*. Ground color of primaries and secondaries light cream on both upper and under surfaces. Over this cream color is a heavy suffusion of brown, having a suggestion of purplish in it. This brown color is spread almost uniformly over both surfaces of both wings, although there is a little tendency in some examples for it to thin out at the base of the primaries and on the inner third of the secondaries. There are no spots or lines on any of the wings, either on superior or inferior surfaces, except for a slight suggestion of darker scaling at the end of the disc of primaries, in

---

[9] Fifth Rep. Peab. Acad. Sci. 79, 1873.
[10] Bull. Brook. Ent. Soc. III, p. 43.
[11] Entom. Amer. I, p. 208.

a few examples. Fringes, purplish-brown. Thorax and abdomen, cream color, sparsely flecked with brown scales.

Described from 8 ♂ ♂ and 7 ♀ ♀ as follows:

Holotype ♂, Bouquet Canyon, Los Angeles County, Calif., June 14, 1937, bred from larva collected on *Adenostoma.*

Allotype ♀, Bouquet Canyon, Los Angeles County, Calif., June 21, 1937.

Paratype No. 1, ♂, San Diego, Calif., May 2, 1920, from collection of Karl R. Coolidge.

Paratypes Nos. 2 to 5, ♂ ♂, Bouquet Canyon, Los Angeles County, Calif., June 21, 1937.

Paratypes Nos. 6 and 7, ♂ ♂, Bouquet Canyon, July 7, 1937.

Paratype No. 8, ♀, Bouquet Conyon, June 14, 1937.

Paratypes Nos. 9 and 10, ♀ ♀, Bouquet Canyon, June 21, 1937.

Paratypes Nos. 11 to 13, ♀ ♀, Bouquet Canyon, July 7, 1937.

Holotype, allotype and a series of paratypes in the collection of the Los Angeles Museum.

A paratype will be deposited in each of the following museums: U. S. National Museum; Canadian National Museum at Ottawa; British Museum, South Kensington, London, England; Museum of the California Academy of Sciences, San Francisco, Calif.

Commander Dammers and the writer have given an incomplete account of the early stages of *Hesperumia sulphuraria* in the Bulletin So. Calif. Academy of Sciences, Vol. 33, No. 1, p. 31, 1934. As an additional aid in identifying the larva a photograph is shown on Plate 56.

PLATE 56
Mature larva of *Hesperumia sulphuraria*, enlarged approximately x 2.

TWO NEW CALIFORNIA COENONYCHA (COLEOPTERA—SCARABAEIDAE)

By Mont A. Cazier
University of California

Members of this genus have always been rare in collections due probably to the fact that their habits and hosts have not been known and the proper collecting methods never applied. It was the author's good fortune to discover that they are nocturnal and occur in great abundance in some localities and if collected properly can be taken in large series. It is the purpose of this paper to present a very profitable method of collecting, two new species and the first host records for members of this genus. Much information obtained from studying large series is withheld in favor of Mr. A. T. McClay who is at present preparing a revision of the genus.

The method of collecting referred to above is that of beating at night with the aid of a lantern. This procedure frequently produces many insects that are seldom taken during the day and was responsible for the two large series recorded herein. It has also been used with success by Dr. E. C. Van Dyke and P. C. Ting in collecting weevils. During the day specimens of *Coenonycha* are in evidence only around the base of the plants just under the top soil and dead leaves, however, shortly after sundown it was found that the plants listed under each species were literally swarming with them. Occasionally a few stray specimens were found on plants other than those given.

The author would like to express his thanks and appreciation to Mr. P. J. Darlington of the Museum of Comparative Zoölogy for comparing specimens and giving necessary information concerning LeContes type of *C. rotundata*. Also to Dr. E. C. Van Dyke and A. T. McClay for loans of material and many helpful suggestions, to E. S. Ross, Hugh B. Leech, M. Embury, A. R. Mead, Roy Wagner, L. W. Saylor and P. C. Ting for material loaned, and to Dr. H. L. Mason of the Department of Botany, University of California, for the determinations of the host plants.

It seems advisable at this time to orient these two new species with respect to other species in the genus. Of the six thus far described *tingi* and *testacea* are most closely related to *rotundata* which is the only large species with fully developed hind wings. *C. stohleri* is small, piceous with greenish lustre and although fully winged can in no way be confused with any of the other

species as they are large and either some variation of testaceous or brown *C. tingi* and *testacea* each have certain characters in common with the type of *rotundata* and through the kindness of P. J. Darlington these differences were summed up as follows: "The type of *rotundata* combines the shorter and broader elytra and dark color of *tingi* with a relatively much narrower prothorax and less densely punctate pronotum as is shown in *testacea*."

Coenonycha tingi Cazier, New Species.

Short, robust, dark brown to piceous. Head coarsely, moderately deeply punctured, small area on apex smooth, punctures smaller posteriorly; frontal suture distinct, feebly impressed; clypeus truncate, margins reflexed, anterior margin more than lateral, angles prominent and produced; antennae seven to ten segmented. Prothorax wider than humeri, almost twice as wide as long; margins slightly angulate at middle, broadly rounded at base, anterior angles prominently produced over eye; pronotum evenly, deeply, moderately densely punctured, punctures separated by their own widths; short, yellowish hairs present throughout surface, less dense on disk; lateral margins with sparse, long, erect setae. Elytra short, less than twice as long as head and prothorax combined, widest at apical third; moderately densely punctured, interspaces only slightly alutaceous; sparsely clothed with short yellow hair; hind wings fully developed or half reduced. Beneath sparsely clothed with short yellow hair. Length 7.5 mm, width 3.5 mm.

Holotype male, allotype female in the author's collection, collected at Napa, Napa County, California, March 30, 1937 by H. B. Leech and the author. Described from a series of 902 specimens (621 males, 281 females) taken on *Adenostoma fasciculatum* by A. R. Mead, M. Embury, H. B. Leech, P. C. Ting and the author. I take great pleasure in naming this species in honor of Mr. P. C. Ting who collected the first specimen on February 14, 1937 and made it possible for the above series to be taken later. Mr. Ting also dug the larvae from around the roots of the above named plant.

Paratypes are deposited as follows: A. R. Mead, 100; M. Embury, 100; H. B. Leach, 20; E. S. Ross, 20; P. C. Ting, 20; A. T. McClay, 20; California Academy of Sciences, 10; L. W. Saylor, 10; P. J. Darlington, 10; E. A. Chapin, 10; A. E. Michelbacher, 10; H. C. Fall, 10; Los Angeles Museum, 10, and the remainder in the author's collection.

This species, as stated previously, is most closely related to *rotundata* although it differs from that species in its wider, differently shaped, more densely punctate pronotum, reduced wings and the genitalia. Within the series there is some variation in

the following characters. In the darker specimens the elytral disk is frequently slightly rugose and alutaceous; the pronotum at times has a few shallow, irregularly placed impressions and the disk in two or three specimens tends to be only sparsely punctured; the lateral clypeal margins in six specimens are only slightly truncate rather than being markedly so. The size varies from 6 to 9 mm. and the color from piceous to light yellowish-brown. The hind wings in the specimens from the type locality are reduced whereas in several specimens from Mt. Diablo and Berkeley, California, the hind wings are fully developed. The number of antennal segments is variable and is frequently not the same on both sides of the same specimen.

COENONYCHA TESTACEA Cazier, New Species.

Elongate, narrow, parallel; head and pronotum light yellowish-brown, elytra testaceous except for suture which in some specimens is piceous or brown. Head impunctate on disk, front with punctures becoming more dense anteriorly; frontal suture distinct, feebly impressed; clypeus truncate, slightly sinuate in front, margins promently reflexed, angles slightly produced; antennae seven to ten segmented. Pronotum narrower or only as wide as elytral humeri; side margins evenly rounded behind, very little angulate at middle and not greatly produced in front; surface shining, sparsely deeply punctate, punctures separated by two to three times their own width, very sparsely clothed with short, fine, yellow hairs, side margins with sparse long hairs. Elytra transparent, shining, elongate, parallel; sparsely, deeply, unevenly punctate, row of prominent sutural punctures forming margin for dark sutural stripe; surface sparsely clothed with short, yellow hair; hind wings well developed and capable of flight. Beneath uniformly testaceous, sparsely clothed with short yellow hair. Length 9 mm., width 3 mm.

Holotype male, allotype female in the author's collection, collected at Clear Creek, Cuyama Canyon, Santa Barbrara County, California, March 7, 1937 by E. S. Ross, Hugh B. Leech and the author. Described from a series of 570 specimens (374 males, 196 females) collected on *Eriogonum fasciculatum*. Paratypes deposited as follows: Hugh B. Leech, 20; E. S. Ross, 20; A. T. McClay, 20; California Academy of Sciences, 10; H. C. Fall, 10; P. J. Darlington, 10; E. A. Chapin, 10; L. W. Saylor, 10; P. C. Ting, 10; A. E. Michelbacher, 10; Los Angeles Museum, 10, and the remainder in the author's collection.

This species is most closely associated with *rotundata* from which it can easily be separated by the elongate, parallel elytra and the light-testaceous color. The series is remarkably uniform in size, shape and color and in only a few cases are the follow-

ing variations evident. In three or four specimens the side margins of the clypeus are not reflexed and the angles not prominently produced. The pronotal punctures are sometimes very small and separated by four to five times own widths. Specimens of this species that agree very well with the type have been taken in Kern County and Claremont, California, showing that it has a wide distribution and will undoubtedly be found in the intervening territory and elsewhere.

The work of the Southern California Academy of Sciences is carried on entirely through the generosity of private citizens, who are sufficiently interested in the advancement of education and cultural endeavor to donate funds or make bequests to the Academy. As a guide, in the matter of bequests, for those who plan to further this program, the following forms are suggested:

Form of Legacy

To be used when it is desired to leave the Academy any personal property, such as money, stocks, bonds, works of art, or other objects of value.

I give and bequeath unto "Southern California Academy of Sciences," of the City of Los Angeles, the sum of.................................... Dollars: To have and possess the same unto the said "Southern California Academy of Sciences," its successors and assigns, to the uses, dispositions and benefits thereof forever.

Form of Devise

To be used when it is desired to leave real estate to the Academy.

I give and devise to "Southern California Academy of Sciences" of the City of Los Angeles, (.. here describe the property or ground rent..), together with the appurtenances, in fee simple, and all policies of insurance covering said premises, whether fire, title or otherwise, free from all taxes: To have and to hold the same unto the said "Southern California Academy of Sciences," its successors or assigns forever.

BULLETIN of the SOUTHERN CALIFORNIA
ACADEMY of SCIENCES

Published by the Academy at Los Angeles, California
Subscription—$2.00 per year

Free to Life Members and Unlimited Annual Members
of the Academy (Annual Membership Fee $5.00)

Address all communications to Dr. John A. Comstock

Care of Los Angeles Museum, Exposition Park,

Los Angeles, Calif., U. S. A.

Publications of the
Southern California Academy of Sciences

The Academy has published to date the following:

PROCEEDINGS, 1896 to 1899. Six numbers—Vol. 1, Nos. 1 to 6.

MISCELLANEOUS BULLETINS issued under the imprint of the Agricultural Experiment Station, 1897 to 1907. *Ten numbers.*

All issues of the above are now out of print.

■ ■

Bulletin of the
Southern California Academy of Sciences

Began issue with Vol. 1, No. 1, January, 1902. Issued ten numbers in 1902; nine numbers in 1903, 1904, 1905; three numbers in 1906. Issued two numbers annually from 1907 to 1919, both inclusive (except 1908—one issue only). Issued four numbers (January, May, July and October) in 1920.

The 1921 issues are: Vol. XX, No. 1, April; Vol. XX, No. 2, August; Vol. XX, No. 3, December.

The 1922 issues are: Vol. XXI, No. 1, March; Vol. XXI, No. 2, September.

The 1923 issues are: Vol. XXII, No. 1, March; No. 2, July.

The 1924 issues are: Vol. XXIII, No. 1, January-February; No. 2, March-April; No. 3, May-June; No. 4, July-August; No. 5, September-October; No. 6, November-December.

From 1925 to 1936, including volumes XXIV to XXXV, three numbers were published each year. These were issued as No. 1, January-April; No. 2, May-August; No. 3, September-December, for each volume.

PUBLICATIONS OF THE SOUTHERN CALIFORNIA ACADEMY OF SCIENCES

For Sale at the Appended Prices

BULLETIN:

	To Members	To Non-Members
Complete set, Vols. 1 to 33, bound		$100.00
(Incomplete set) Vols. 8 to 33, bound		80.00
Vol. 3, No. 7, 1904	$ .25	.50
" 4, " 5, 1905	.25	.50
" 6, " 1, 1907 (Photostat only)	2.00	4.00
" 6, " 2, 1907	.25	.50
" 7, " 1, 1908	1.00	2.00
" 8, " 1, 1909	1.00	2.00
" 9, " 1, 1910	2.00	4.00
" 9, " 2, 1910	.75	1.50
" 10, " 1, 1911	1.00	2.00
" 10, " 2, 1911	2.00	4.00
" 11, " 2, 1912	1.00	2.00
" 12, " 1, 1913	1.00	2.00
" 15, " 2, 1916	.75	1.50
" 16, " 2, 1917	1.00	2.00
" 17, " 1, 1918	2.00	4.00
" 17, " 2, 1918	1.50	3.00
" 18, " 2, 1919	2.00	4.00
" 19, " 1, 1920	.50	1.00
" 19, " 4, 1920	.50	1.00
" 20, " 1, 1921	2.00	4.00
" 20, " 2, 1921	2.00	4.00
" 20, " 3, 1921	2.00	4.00
" 21, " 1, 1922	2.00	4.00
" 21, " 2, 1922	1.00	2.00
" 22, " 1, 1923	1.50	3.00
" 22, " 2, 1923	2.00	4.00
" 23, " 1, 2, 3, 4, 5, 6, 1924 (each)	.25	.50
" 24, " 1, 2, 3, 1925 (each)	.25	.50
" 25, " 1, 1926	2.00	4.00
" 25, " 2, 3, 1926 (each)	.25	.50
" 26, " 1, 2, 3, 1927 (each)	.25	.50
" 27, " 1, 2, 3, 1928 (each)	.25	.50
" 28, " 1, 2, 3, 1929 (each)	.25	.50
" 29, " 1, 2, 3, 1930 (each)	.25	.50
" 30, " 1, 2, 3, 1931 (each)	.25	.50
" 31, " 1, 2, 3, 1932 (each)	.25	.50
" 32, " 1, 2, 3, 1933 (each)	.25	.50
" 33, " 1, 2, 3, 1934 (each)	.25	.50
" 34, " 1, 2, 3, 1935 (each)	.25	.50
" 35, " 1, 2, 3, 1936 (each)	.25	.50
" 36, " 1, 2, 3, 1936 (each)	.25	.50

Miscellaneous, Publications of Affiliated or Co-operating Organizations:

Lorquinia—Vols. 1, 2 (all published) . . . bound $1.50, unbound $1.00

Southern California Geology and Los Angeles Earthquakes, R. T. Hill . . . . . . bound 5.00

Southwest Science Bulletin, May 5, 1920 (all published), chiefly Entomological, 1 colored plate 1.00

Check-list of the Recent Bivalve Molluscs (of N. W. Coast of Am. from the Polar Sea to San Diego), W. H. Dall 1.00

(Continued on next page)

PUBLICATIONS (*continued*)

Reprints:

Check-list of the Lepidoptera of Boreal America. Superfamilies Sphingoidea, Saturnioidea and Bombycoidea (printed on one side of page only, to allow of additional notes), Wm. Barnes and Foster H. Benjamin, 1927 ....$ .50

The Cacti of the Pyramid Peak Region, Dona Ana County, New Mexico, 1931. F. R. Fosberg .... .25

ADDRESS ALL INQUIRIES TO

SOUTHERN CALIFORNIA ACADEMY OF SCIENCES
(Care DR. JOHN A. COMSTOCK)
Los Angeles Museum, Exposition Park,
Los Angeles, California, U. S. A.

Bulletin, Southern California Academy of Sciences

Vol. XXXVI, 1937

INDEX OF SUBJECTS

New species and varieties indicated in **bold face type.**

INDEX OF AUTHORS

REPRINTS: Contributors of articles accepted for publication in the *Bulletin* should order reprints, if desired, when they return galley proof to the Editor. They may be ordered through the Editor at the following rates, from the McBride Printing Co., 415 East Eleventh Street, Los Angeles, Calif., the contributor paying for all his reprints.

PRICE LIST OF REPRINTS

(WITHOUT COVERS)

	4pp.	8pp.	12pp.	16pp.	20pp.	24pp.	28pp.	32pp.
50 copies	$3.75	$ 5.75	$ 8.50	$10.25	$11.75	$13.50	$16.00	$17.00
100 "	4.50	7.50	10.75	12.75	15.00	17.25	20.25	21.50
150 "	5.25	9.25	13.00	15.25	18.25	21.00	24.50	26.00
200 "	6.00	11.00	15.25	17.75	21.50	24.75	28.75	30.50
250 "	6.75	12.75	17.50	20.25	24.75	28.50	33.00	35.00
300 "	7.50	14.50	19.75	22.75	[illegible]	32.25	37.25	39.50

Covers: 50 for $2.00—additional covers 1½c each.

California State 3% Sales Tax to be added if delivered within the state.

BULLETIN OF THE Southern California Academy of Sciences

LOS ANGELES, CALIFORNIA

Nostra tuebimur ipsi.

Vol. XXXVII January-April, 1938 Part 1

CONTENTS

Issued April 30, 1938

Southern California Academy of Sciences

Office of the Academy
Los Angeles Museum, Exposition Park, Los Angeles, Cal.

NOTES ON THE FLORA OF THE CHARLESTON MOUNTAINS, CLARK COUNTY, NEVADA

By Ira W. Clokey

The collections of several botanists, especially Mr. A. A. Heller and Dr. E. C. Jaeger, from the Charleston Mountains demonstrate that this is a region of unusual endemism. A more intensive exploration of these mountains, carried on during the last three years, has resulted in the discovery of a number of additional undescribed forms.

1. **Calochortus rhodothecus** Clokey sp. nov.

Caules sine bulbulis basalibus, 4 dm. alti aut breviores; foliis 3-4, anguste linearibus, 3-7 cm. longis, albomarginatis certe juxta basem, plerumque in anthesis marcidis; bractea aut bracteis similis; floribus 1-2 (-3), erectis, poculiformibus; sepalis 2-3 cm. longis, 4-8 mm. latis, lanceolatis, acutis aut obtusis, cum margine alba et hyalina, extrinsecus viridibus aut subviolaceis, interne albis, plerumque cum macula flava basale, cum aut sine signo violaceo supra et infra; petalis 2.5-4 cm. longis, 1.7-3 cm. latis, cuneatis, obovatis, apiculatis, integris aut minute erosis, albis aut partim citrinis et (aut) violaceo- puniceis, cum linea lata viride longitudinale; glandula cum macula flava et paucis capillis simplicibus et area violaceo-punicea supra et plerumque infra; glandula leviter depressa, circulare aut elliptica, cum membrana laciniata et capillis flavis simplicibusque; antheris 7-8 mm. longis, rosaceis; filamentis hyalinis, 7-8 mm. longis; stigmatis non purpureis; capsulis lanceolatis, non alatis, ca 5 cm. longis, 1 cm. latis.

Stems without bulblets near base (small bulbs were found on 8 out of 500 plants), 4 dm. high or less. Leaves 3-4, narrowly linear, 3-7 cm. long, more or less white margined at least near the base, usually withered at anthesis. Bract or bracts similar. Flowers 1-2 (-3), erect, open bowl shaped. Sepals shorter than the petals, 2-3 cm. long, 4-8 mm. wide, lanceolate, acute or obtuse, with broad, white, hyaline margin; externally green or tinged with violet carmine; inside white, usually with a yellow spot near the base, with or without a violet carmine mark above and below. Petals 2.5-4 cm. long, 1.7-3 cm. wide, cuneate obovate, apiculate, entire or very slightly erose, white

or tinged near tip with yellowish citrine and (or) violet carmine, with a distinct longitudinal green band (internal color yellowish citrine, Ridgeway's Color Standards and Nomenclature XVI 23' i; external color the same or with added tinge of violet carmine); yellow spot with a few unbranched yellow hairs surrounding the gland, with violet carmine (Ridgeway's XII 69 m) above and usually below; gland slightly depressed, circular or elliptical, surrounded by a deeply laciniate membrane, covered with unbranched yellow hairs. Anthers 7-8 mm. long, old rose (Venetian pink—Acouja red, Ridgeway's XIII 1' f-i). Filaments hyaline, of same length as anthers. Stigmas without any purple coloring. Capsule lanceolate, wingless, ca. 5 cm. long, 1 cm. wide.

Charleston Park, in the yellow pine belt at an elevation of 2270 m., July 12, 1937, *Clokey 7479* (type, Clokey Herbarium). Other collections from the Charleston Mountains are: Charleston Park, yellow pine belt, elev. 2270 m., July 11, 1936, *Clokey 7047* (topotype); Griffith's mine, pinyon association, elev. 2425 m., July 7, 1936, *Clokey 7046;* Kyle Canyon, yellow pine belt, elev. 2270 m., July 5, 1936, *Clokey 7043*, (topotype), pinyon association, elev. 2270 m., June 21, 1926, *Jaeger;* Kyle Canyon-Deer Creek, pinyon belt, 2425 m., July 3, 1936, *Clokey 7045;* Lee Canyon, juniper belt, elev. 2000 m., July 3, 1936, *Clokey 7044;* Trout Creek, elev. 2100 m., June 26, 1926, *Jaeger.*

The Jaeger plants were distributed as C. *Nuttallii* Torr. The two species can be distinguished as follows:

C. *rhodothecus*	C. *Nuttallii*
Bulblets near base of stem rare.	Bulblets near base of stem.
Anthers old rose, 7-8 mm. long.	Anthers yellow, 10 mm. long.
Hairs on gland unbranched.	Hairs on gland branched.
Green longitudinal stripe on petals.	No green longitudinal stripe on petals.

Calochortus rhodothecus is apparently restricted to the Charleston Mountains where it is widely scattered in the yellow pine and pinyon belts. It belongs to the group with the longitudinal green stripe on the petals. The members of this group can be separated by the following key:

A. Sepals 3.5-5 cm. long; petals 3.5-6 cm. long; anthers yellow, 10-15 mm. long.

B. Anthers 10-12 mm. long, lanceolate.

C. Hairs on gland fungoid ...... *C. macrocarpus* Dougl.

CC. Hairs on gland not fungoid .... *C. maculosus* Nels. & Macbr.*

BB. Anthers 12-15 mm. long, cylindrical, hairs on gland fungoid .... *C. cyaneus* Nels.*

AA. Sepals 2-3 cm. long; petals 2.5-4 cm. long; anthers less than 10 mm. long.

B. Stigmas purple; no pubescence surrounding gland.

C. Claw brown; anthers 6-8 mm. long; stem straight; green band external only** .... *C. discolor* Davidson

CC. Claw yellow; anthers 8.5-9 mm. long, purple; stem tortulos; green band internal as well as external .... *C. bruneaunis* Nels. & Macbr.

BB. Stigmas showing no purple; anthers 7-8 mm. long, old rose; pubescence around gland; stems straight; hairs on gland unbranched; green band internal and external.

C. rhodothecus.

* Macbride (Contributions from the Gray Herbarium No. LVI, 14) reduces these two species to varieties of *C. macrocarpus*. In doing so he does not bring out the difference in the hairs on the gland and the size and shape of the anthers.

** The type of *C. discolor* has no attached anthers so that the color could not be determined.

2. Aquilegia scopulorum Tidest. subsp. **perplexans** Clokey subsp. nov.

The rare *Aquilegia scopulorum* has been collected at a few stations of high elevation from southwestern Wyoming to north-central Nevada. The typical plant has the flowers pale blue except for the laminae which are yellow or white. Payson (Cont. U. S. Nat. Herb., vol. 20, part 4) places it in his section Macroplectrae which he defines as having blue, white or yellow flowers. In his key for the genus he further characterizes this section: "Spurs slender, straight, usually more than 3.5 cm. long, never red."

A form of *Aquilegia Scopulorum* occurs as an alpine plant on Charleston Peak. This Charleston Mountain plant matches A. *scopulorum* in manner of growth, structure and relative proportions of the floral parts and, except in a few unusual plants, in the vegetative characters, but differs in having blue, red, blue and white, red and white, occasionally white and rarely yellow flowers.

Field observations covering different areas of the population, in 1935, 1936 and 1937, and the study of a considerable amount of herbarium material, demonstrate that this variation in flower color has no correlation with age of flower but is the result of segregation of a genetic mutation.

Subspecies *perplexans* subsp. nov. is based on this occurrence of blue, red, blue and white, red and white, red and yellow, occasionally white and rarely yellow flowers. (Flores coerulei, rubri, coerulei albique, rubri albique, rubri flavique, pro re nata albi, raro flavi.)

Type: *Clokey 7094,* Clokey Herbarium, collected on a broken rocky slope above timberline on Charleston Peak, elev. 3510 m., July 16, 1936. *Clokey 5464,* (topotype) showing flowers and fruit, was collected August 8, 1935.

No evidence of a hybrid origin was observed. The only red columbine in the Charleston Mountains, A. *formosa* Fisch. subsp. *caelifax* Payson, is found within a few miles of this alpine plant, but has been observed only in the juniper, yellow pine and pinyon belts, and at least 600 m. lower. The red color of subsp. *perplexans* is Daphne red and tones (Ridgway's Color Standards and Nomenclature XXXVIII) while that of A. *formosa* subsp. *caelifax* is Eugenia red (Ridgway's XIII). The vegetative characters and flower structure of subsp. *caelifax* have not been found in subsp. *perplexans.*

This Charleston Mountains columbine is evidently derived from the typical species and is the result of a partially completed step towards the more highly specialized red color. A series of red flowered plants could be chosen that would, by themselves, justify a new species. On the other hand plants might be selected that, phenotypically, could not be differentiated from the typical species.

The section Macroplectrae should be expanded to cover red flowers in order to include this subspecies.

3. **Potentilla cryptocaulis** Clokey sp. nov.

Perennis, cum caulibus longis tenuibus et subterraneis, tapitem similans, 2-3 cm. alta; caulibus subterraneis cum squamis ferrugineis nitidisque, cum apice aerio perenne squamato ca. 5 mm. singulis annis cresente, cum radicibus paucis et pro re nata cum surculis; foliis caulibusque cum capillis brevibus et glandulosis et cum capillis longioribus et eglandulosis; foliis basalibus 2-4 (-6), pinnatis; laminis anguste linearibus, teretibus, 6-18 mm. longis; petiolis brevioribus; stipulis lanceolatis, acutis, petiolum semiadnatis, capillis longis albisque fimbriatis; foliolis 11-17, 3-5 segmentis ellipticus palmate divisis, setulosis; caulibus florescentibus ad 5 cm. longis, inclinatis, arcuatis aut prostratis, scaposis aut cum folio integra aut 2-3 diviso; stipulo simplice

PLATE 1

Potentilla cryptocaulis Clokey.
Approximately x 2/5.

aut palmate diviso, petiolum parte adnato, perfoliato; inflorescentia congesto-corymbosa; calyce cum pubescentia breve glandulosa et longiore eglandulosa; hipanthio ca. 1.5 mm. alto, 2.5-3 mm. lato, cupulato; sepalis anguste triangularibus, acutis, 1.5-2 mm. longis; bracteolis linearibus, ca. 1-1.5 mm. longis; petalis linearibus spathulatis, rotundatis aut obtusis, 2.5-3 mm. longis, receptaculo cum capillis albis 1 mm. longis; staminis 5, sepalos non equantibus, acheniis 6-10.

Perennial, occurring as a carpet 2-3 cm. high: long slender, underground stems clothed with light brown, shining scales, with an aerial, perennial tip covered with old bracts and scales, increasing ca. 5 mm. a year; underground stems to a limited extent producing roots and occasionally forming offsets: herbage with short glandular and longer eglandular hairs: basal leaves 2-4 (-6), pinnate; blades narrowly linear, terete, 6-18 mm. long; petiole shorter than the blade; stipules lanceolate, acute, lower half attached to the petiole, ciliate; leaflets 11-17, divided palmately to the base into 3-5 elliptical segments, bristle tipped: flowering stems 5 cm. or less long, inclined, arcuate or prostrate, seldom lifting the flowers much above the basal leaves, scapose or with a cauline leaf undivided—2-3 palmately divided; stipule simple or palmately divided, lower part attached to the petiole, perfoliate: Inflorescence congested corymbose; hypanthium ca. 1.5 mm. high, 2.5-3 mm wide, cupulate; sepal lobes narrowly triangular, acute, 1.5-2 mm. long; bracteolets linear, ca. ⅔ length of sepal lobes: petals linear, spatulate, rounded or obtuse, 2.5-3 mm. long: receptacle with stiff white hairs 1 mm. long: stamens 5, shorter than the sepal lobes: achenes 6-10.

Gravelly slope and flat at timberline on Charleston Peak, elevation 3500 m., July 8, 1937, *Clokey 7567* (type, Clokey Herbarium). At the same station August 8, 1935, *Clokey 5504,* (topotype).

The long slender underground stems, resulting in a carpet like growth, distinguishes this species from the closely tufted *Potentilla Shockleyi* (Wats.) Jeps., P. *Gordonii* Greene var. *lycopodioides* (Gray) Greene and P. *Gordonii* var. *pygmaea* (Gray) Jeps. Further P. *Shockleyi* has only 1-5 achenes, var. *lycopodioides* is glabrous and var. *pygmaea* has ten stamens and more than 10 achenes.

4. **Ditaxis diversiflora** Clokey sp. no.

Perennis, monoecis; caulibus numerosis ex radice crassa, 15 cm. altis aut brevioribus anthese, 30 cm. altis aut brevioribus fructu, glabris, striatis, rubidis aut subcoeruleis; foliis sessilibus, integris, glabris in superficiebus, cum paucis capillis marginalibus, prominente venosis, 1.5-3.5 cm. longis; inferioribus

late ellipticis, obtusis; brevioribus quam superioribus, lanceolatis, acutis; floribus staminatis cum 5 sepalis granularibus, glabris aut cum paucis capillis marginalibus basalibusque, ca. 5 mm. longis cum apicibus recurvatis et mucronatis; petalis 5, ca. 5 mm. longis, spathulatis, albis aut subrosaceis venis rubris, integra aut erosis; staminis 10 cum filamentis connatis et rubis; floribus pistillatis cum 5 sepalis lanceolatis et acuminatis, ca. 6 mm. longis, granularibus, cum paucis capillis marginalibus; petalis 5, ca. 4 mm. longis, spathulatis, albis cum venis coeruleis aut coeruleo-viridibus; ovariis 3-loculatis, 3-lobatis, globosis, pauce strigulosis; stylis 3, 2 mm. longis aut brevioribus, semi-conjunctis; capsulis 3-lobatis, profunde depressis, 4 mm. altis, 5-5.5 mm. latis, granularibus; seminibus ca. 4 mm. longis, 3 mm. crassis, scabris.

Monoecious perennial. Stems numerous from a thick root, 15 cm. or less high at anthesis, up to 30 cm. high at maturity of fruit, glabrous, dull, grooved, in drying variously tinged or striate with red or blue (or blue green). Leaves sessile, entire, glabrous except for a few marginal hairs, prominently veined, 1.5-3.5 cm. long; lower broadly elliptic, obtuse, shorter than the upper which are lanceolate acute. Staminate flowers with 5 somewhat granular sepals, glabrous or with a few marginal hairs near the base, ca. 5 mm. long, recurved above with minute mucronate calous tips; petals 5, about 5 mm. long, spatulate, white or tinged with red, with red veins, entire or somewhat erose; stamens 10 with red monodelphous filaments. Pistillate flowers with 5 lanceolate, acuminate sepals ca. 6 mm. long, granular, glabrous except for a few marginal hairs: petals 5, ca. 4 mm. long, spatulate, white with blue or blue green (rarely red) veins. Ovary 3 celled, 3 lobed, globose, with a few white appressed hairs, drying blue: styles 3, 2 mm. or less long, united for half their length, forked approximately at the stigmas. Capsule 3 lobed, deeply depressed, 4 mm. high, 5-5.5 mm. wide, granular. Seeds ca. 4 x 3 mm., rough.

On a brushy south slope, yellow pine belt, at an elevation of 2280 m., Charleston Park, in flower May 24, 1937, *Clokey 7576* (type, Clokey Herbarium). Other collections from the type locality are: in flower May 11, 1936, *Clokey 7185;* in fruit June 19, 1937, *Clokey 7577.*

Ditaxis diversiflora is closest to D. *cyanophylla* Wooton & Standley. Aside from the geographical separation it is differentiated from that species as follows:

D. diversiflora	*D. cyanophylla*
Not over 15 cm. high at anthesis or over 30 cm. at maturity.	30-40 cm. high.
Leaves dull.	Leaves shining.

Does not turn water red on soaking.	Stains water red on soaking.
Sepals of staminate flowers 5 mm. long, narrowly linear, acute. Sepals of pistillate flowers 6 mm. long, lanceolate acuminate.	Sepals 6-7 mm. long, lanceolate acuminate, in both staminate and pistillate flowers.
Petals of staminate flowers white diffused with red and with red veins. Petals of pistillate flowers white with blue or blue-green veins.	Petals of staminate flowers yellow with red veins.
Seeds elliptic, rough.	Seeds spheroidal, smooth.

5. **Angelica scabrida** Clokey and Mathias, spec. nov.

Planta *A. tomentosae* simulans; foliolis 8-16 cm. longis, 2-7 cm. latis, glabratis, spinuloso-dentatis; umbellis 25-32-radiatis, radiis inaequalibus, 1-7.5 cm. longis, scabris, pedicellis scabridis, fructibus oblongis, ad basim versus angustatis, 8-14 mm. longis, 4-5 mm. latis, sparse scabris vel glabratis, jugis dorsalibus filiformibus obsoletisve, alis lateralibus quam corpore angustioris.

Plants caulescent, up to 15 dm. tall, the stems more or less pubescent, especially at the nodes; basal leaves large, ternate-pinnate, the leaflets lanceolate to ovate-lanceolate, 8-16 cm. long, 2-7 cm. broad, acute, oblique to cuneate at the base, occasionally lobed near the base, irregularly spinulose-dentate, glabrate, the terminal leaflet usually petiolulate, the lateral leaflets mostly sessile, the upper leaves smaller with the petioles entirely sheathing, reduced above to a conspicuous sometimes purplish sheath; umbels lateral and terminal, the terminal elongated, the fertile umbels 25-32—rayed, the rays all fertile, unequal, 1-7.5 cm. long, spreading, somewhat fused at the base, scabrous, the umbellets about 40-flowered, the pedicels 2-12 mm. long, somewhat fused at the base, scabrous, the involucre usually absent or of one sheath-like bract, the involucel absent or of one linear bract; flowers white, the petals scabrous on the dorsal surface, the stamens exserted, the ovary scabrous; fruit oblong, narrowed toward the base, 8-14 mm. long, 4-5 mm. broad, sparingly scabrous to glabrate at maturity, the dorsal ribs filiform to obsolete, the lateral wings narrower than the body, the oil tubes solitary in the intervals or two in the lateral intervals, 2-4 on the commissure, the stylopodium low-conical.

Type specimen: *I. W. & C. B. Clokey 5548,* wash and north slope, yellow pine belt, 2200-2400 meters, Charleston Park, Charleston Mts. Clark Co., Nevada, 4 August 1935, 10-25 July 1936 (type, Clokey Herbarium).

PLATE 2

Angelica scabrida Clokey & Mathias.
Approximately x ⅓.

This interesting species of *Angelica* is very closely related to *Angelica Breweri* Gray of the Sierra Nevada range in California and adjacent Nevada and to *A. tomentosa* Wats. of the coast ranges of northern California and coastal southern California. It differs from both these species in the scabrous pubescence of the inflorescence, the inconspicuous dorsal ribs of the fruit, the narrower lateral wings, the usually longer fruit and usually larger leaflets. The foliage is close to that of *A. tomentosa* in texture and general appearance but the leaf margins are more strikingly spinulose-dentate and the leaves are never puberulent. The relationships may be seen in the following key:

Fruit glabrous to somewhat pubescent, 6-9 mm. long, the lateral wings about equalling the body; leaflets serrate.

Foliage puberulent to glabrate.

Rays subequal; ovary tomentulose; plants of the coast ranges of California .... *A. tomentosa*

Rays unequal; ovary hispid; plants of the Great Basin .... *A. Wheeleri*

Foliage glabrous .... *A. Breweri*

Fruit more or less scabrous, 8-14 mm. long, the lateral wings narrower than the body; leaflets spinulose-serrate .... *A. scabrida*

The plants were found growing in only one canyon extending over an area about a mile and a half long. They occurred in the gravel wash in the bed of the canyon and on the north facing slopes on the south side of the canyon associated with *Populus aurea*. The plants were most abundant and luxuriant in the bed of the canyon reaching a height of about five feet. They extended up the slope to a height of 500 to 600 feet above the canyon floor. The maximum height of the plants on the slope was about three feet.

6. **Senecio Andersonii** Clokey sp. nov.

Plantae perennes, virides, suffrutescentes, 5-10 dm. altae, aequaliter latae; caulibus striatis, solum supra ramosis; caulibus et foliis saltem aetate glabrescentibus, saepe in axillis tomentosis; foliis pluribus, non supra reductis, integris, anguste linearibus, acutis; foliis caulium principalium 5-12 cm. longis, 2-4 mm. latis, ad basem latitudine unius formae; foliis ramorum bracteisque similibus sed parvioribus; inflorescentia corymbosa; capitibus numerosis; involucris anguste campanulatis; bracteis floralibus 8, 5 mm. altis, non carinatis, linearibus abrupte acutis plerumque cum apicibus brunneis aut atris, glabris sed cum cristula capillorum intra et apice; bracteis calyculatis compluribus,

minutis, cum apicibus brunneis aut atris; ligulis 4-5, 6-7 mm. longis, 2 mm. latis, 4 venosis, apice rotundatis cum 2 incisuris minutis; floribus disci 6-9; acheniis glabris aut hirtellis.

Perennial. Plants light green, suffrutescent at base, 5-10 dm. high and as wide. Stems striate, unbranched at base, above numerous flowering branches. Stems and leaves glabrous at least in age, frequently white tomentose in axils of the leaves. Leaves many, not noticeably reduced upwards, entire, narrowly linear, acute; on main stem 5-12 cm. long, 2-4 mm. wide, uniform in width to base; on branches similar but smaller. Bracts similar. Inflorescence corymbose. Heads numerous. Involucre narrowly companulate. Floral bracts 8, 5 mm. high, not carinate, linear, abruptly acute, usually dark brown or black tipped, glabrous except for a small tuft of hairs inside at tip. Calyculate bracts several, minute, with dark brown or black tips. Ligules 4-5, 6-7 mm. long, 2 mm. wide, four veined, rounded at apex with two minute notches producing three rounded lobes. Disk flowers 6-9. Achenes glabrous or hirtellous.

Lee Canyon in the yellow pine belt at an elevation of 2550 m., August 5, 1935, *Clokey* and *Anderson, 5638* (type, Clokey Herbarium). Other collections are: Charleston Park, yellow pine belt, elev. 2270 m., July 10, 1936, *Clokey 7411* and *7448;* Clark Canyon, juniper belt, elev. 2270 m., July 12, 1936, *Clokey 7410;* Lee Canyon, yellow pine belt, elev. 2550 m., August 1, 1935, *Clokey 5637* (topotype).

This species belongs to the *Suffruticosi* Greenman and to *Longilobi* Rydberg. Owing to the narrow linear, entire leaves it could be confused only with *Senecio spartioides* T. & G. From this species it can be separated by the following key:

Bracts 8, not carinate, 5 mm. long, achenes glabrous or hirtellous .... *Senecio Andersonii*

Bracts about 12, carinate, 6-9 mm. long, achenes silky canescent .... *Senecio spartioides*

It is a pleasure to name this species for Dr. E. G. Anderson of the California Institute of Technology, Pasadena, California.

South Pasadena, California
March, 1938

NEW ACMAEODERA AND CHRYSOBOTHRIS FROM THE SOUTHWEST (Coleoptera-Buprestidae)

By Mont A. Cazier
University of California, Berkeley

My thanks and appreciation are due the following friends who loaned and exchanged material and gave assistance in the study of the species treated herein: Dr. E. C. VanDyke, C. W. Leng, R. P. Allen, F. R. Platt, A. T. McClay and F. H. Parker.

Acmaeodera humeralis Cazier, new species

Small, robust, flattened; irregularly clothed throughout with squamae and short stout hair; head, prothorax and elytral margins cupreous-black, elytral disk dark rusty-red, humeri black; beneath uniformly black. Head shallowly, densely punctate, each puncture with a moderately long, stout, squamiform hair; clypeus emarginate; antennae with fourth and succeeding segments uniformly wider than third. Pronotum unicolorous, scarcely wider than elytra, shallowly cribrate, sides evenly rounded, widest at basal third, front and hind margins sinuate, base with a deep foveae on each side at base of well defined oblique lateral sinus, disk moderately clothed with elongate, narrow, squamiform pile, sides with dense stout squamae. Elytra sinuate just posterior to well defined humeral umbone, as wide at apical third as at base, side margins deeply serrate and visible only at apical half, apices blunt and flattened, each elytron rounded and serrate to apical third, a shallow transverse furrow extending across disk at basal third; elytral striae shallowly punctate, striae one to six continuous from base to apex, stria seven extending only to apical third, interspaces one to five with squamiform hair that are shorter and stouter at base, remainder of rows with uniform slender squamiform hair throughout, interspaces three and five with double set of squamae at base, row three more heavily squamose throughout than others; each elytron with narrow black border which is widest at base, disk dark rusty-red. Prosternum truncate in front. Beneath rather densely squamose throughout; last ventral segment with a single apical border.

Length 4 mm., width 2 mm.

Holotype in the author's collection, one paratype in the collection of Mr. Frank H. Parker. Type locality Amboy, San

Bernardino Co., California, April 30, 1937. The two specimens from which this species is described were collected by the author on the flowers of *Geraea canescens.*

This species is most closely related to *insignis* and *rossi* of the species thus far described but is very distinct from either in many ways. It differs from both of these in the discal color and the unbroken extent of this coloration, by the smaller size and more robust shape. From *insignis* it can be further distinguished by the presence of wider squamiform hairs which are more densely arranged on the front of the head, the sides of the prothorax, the base of the elytra and the under surface. In *insignis* the pile is less squamiform and more sparsely arranged, the elytra having no squamae at the base as there are in *humeralis.* The apices of the elytra are much more flattened in *humeralis* and the lateral margins visible for a greater portion of their length. The humeral depression is more pronounced in *humeralis* than in *insignis.* From *rossi* it can be distinguished by its smaller size, the smaller squamiform hair and its arrangement. In *rossi* the elytra are uniformly clothed with squamae, which are more densely arranged on the head, pronotum and undersurface.

Three specimens belonging to the *insignis* group of the truncate species that were collected at Gila Bend, Arizona, April 25, 1935, were loaned to the author by Mr. F. H. Parker and are here considered as *insignis.* There is a slight difference in the character of the markings which are continuous instead of spotted a in typical *insignis,* but inasmuch as this character is variable it seems to me that these Arizona specimens properly belong with it.

In H. C. Falls' key (1899) to the species belonging to the truncate group, *insignis* and *gemina* are separated from all the other species by the antennae which have the fourth segment larger than the second or third and about the same size as the fifth. In this key it is impossible to reach *cribricollis* which properly belongs in the section with *insignis* and *gemina* as *cribricollis* is placed according to Fall in another group, that is with those species having the fifth segment of the antennae suddenly broader than the fourth. The female of *cribricollis* has the fourth segment longer and slightly more expanded apically than the third whereas the male has the fourth segment longer and about three times as broad as the third. When properly keyed *cribicollis* will be associated with *gemina* as the vestiture of the under surface is hairy. It can easily be separated from that species however by its elongate form, larger size, the longer pile on the dorsal surface and by the markings which are transverse rather than lingatudinal. As far as I know *insignis, rossi, humeralis, cribricollis* and *gemina* are the only species of North American *Acmaeodera* having the antennae as described above.

Chrysobothris platti Cazier, new species

Narrow, subcylindrical, uniformly brilliant sericeous green with faint cupreous tinge in the disk of each elytron. Head deeply somewhat densely punctate on vertex, each puncture separated by its own width, gradually more shallowly and densely punctate toward clypeus, anterior punctures giving rise to moderately long white hair, interspaces sericeous, prominent median carinae becoming obsolete at middle of front, eyes widely separated; clypeus cribrately punctured, each puncture containing a moderately long white hair, elevated emarginate line extending from outside angles to middle of base, front margin truncate, middle portion slightly darker than remainder, basal clypeal impression shallow; antennae cupreous-green at base becoming cupreous-black toward tip, acutely serrate, the lower edge not greatly broadened, third segment as long as fourth and fifth combined. Pronotum glabrous, twice as wide as long, widest at apical third, sides evenly arcuate, disk sparsely, irregularly, shallowly, punctate, punctures separated by two to five times their own diameters, side margins shallowly, densely punctate, without callosities, interspaces sericeous. Elytra glabrous, slightly wider than pronotum, parallel to apical third, apices separately rounded, not completely covering abdomen, margins feeble serrate; disk convex, with faint trace of four costae, the first extending only to basal third, the second to apices, the third and fourth united at apical fourth and proceeding to apices; basal fovea deep; surface rather densely, irregularly, shallowly punctate, many punctures transversely connected by shallow impressions, interspaces sericeous. Beneath uniformly green; sparsely, shallowly, asperately, punctured; abdominal segments without lateral umbone, the angles prominent, last segment with prominent entire apical margin, lateral margin not serrate or interrupted; anterior femur with a short broad tooth, serrulate on its distal edge.

Length 12 mm., width 4 mm.

Holotype female in the author's collection. Type locality Snow Creek, Riverside Co., California, June 8, 1936. Collected on Ephedra sp. by Mr. F. R. Platt after whom I take great pleasure in naming the species.

Male: Head as in the female except that the front is more densely, shallowly punctate; antennae as in the female. Pronotum evenly arcuate, widest at about middle; surface with shallow confluent punctures, anterior portion of disk with several transverse, arcuate, sericeous callosities, median line more or less prominent. Elytra as in the female except for the slightly more cupreous color and the much less conspicuous costae. Beneath with larger more densely placed asperate punctures; terminal abdominal segment with lateral ridge, apical margin obtusely emarginate.

Length 10 mm., width 4 mm.

Allotype male in the collection of Mr. A. T. McClay. Collected at Whitewater, Riverside Co., California, June 28, 1937, by Mr. McClay and very kindly loaned to the author for study.

The female of this species will key out in G. H. Horn's key (1866) to group VII due to the presence of faint but definite costae whereas the male will key to group VIII because of the almost complete lack of costae. After a careful study of the species in both groups the author is inclined to place *platti* with those species in group VIII which would normally be without elytral costae but which sometimes have evidences of them as in *atrifasciata.* Within the group *platti* is most closely associated with *atrifasciata* and *ulkei* from which it can be at once distinguished by the following characters: the more sericeous appearance, the lack of transverse black fasciae, the shape of the pronotum, the truncate clypeus, color of front of head and under surface which are green rather than dark cupreous, the lack of pronotal callosities in the female, the acute serrations of the antennae in the female, the lack of bipectinate antennae in male, the much less acute tooth on front femur, and the narrow shape.

The only other members of group VIII are *prasina* and *socialis.* From *prasina, platti* differs by being larger, having the apical end of abdomen exposed, the pronotum evenly arcuate, the occiput with a carina, clypeus truncate, presence of elytral costae in the female, deep basal fovea, and the green undersurface. From *socialis* (Arizona) *platti* can be distinguished by the following characters: narrower form, sericeous green color, lack of elytral dark spots, more irregular, deeper punctures on head, lack of deep transverse and vertical impressions on front of head, by truncate rather than deeply sinuate front margin of clypeus, shape of pronotum which is less convex dorsally and more rounded on the sides, elytral punctures deeper and more dense, beneath more convex, apical margin of last abdominal segment without lateral projections.

Chrysobothris alleni Cazier, new species

Moderately robust, convex; brilliant cupreous-green above, greenish-blue beneath. Head with vertex glabrous, shallowly, confluently punctate, median carinae prominent, extending to small shallow impression on front between eyes, anterior two-thirds of front with moderately deep, irregular, dense, confluent punctures each of which gives rise to a short white hair; clypeal punctuation like the anterior portion of front but with the hairs longer, front margin shallowly, obtusely emarginate; antennae simple, serrate, the lower edge broader than usual, inner angles acute. Pronotum glabrous, nearly as wide as elytra, twice

as wide as long; sides obtusely angulate behind middle, apical portion weakly arcuate, basal portion straight or slightly emarginate; surface with middle of disk slightly impressed, entire surface rugosely-punctate, the punctures varying in depth, interspaces nearly smooth. Elytra glabrous, finely serrate, side margins straight, gradually widened to apical third and then arcuately narrowed to apices which are separately rounded and do not cover abdomen; disc of each elytron uneven, base densely punctate, asperate, transverse impressions connecting many of the punctures, apices irregularly, shallowly punctate, interspaces sericeous, shining; basal fovea deep. Beneath rather densely, asperately punctate; lateral margins of last ventral segment not serrulate, apical margin obtusely serrulate, ante-apical ridge obscure; anterior femur with an acute, unserrulated tooth.

Length 12 mm., with 5 mm.

Holotype female in the author's collection, one female paratype in the collection of Mr. R. P. Allen. Type locality 20 miles east of Tuba City, Arizona, July 22, 1937. Collected by R. P. Allen after whom I gratefully name the species.

MALE: Head as in the female; clypeus more deeply emarginate; antennae bipectinate from the fourth segment, anterior branches shorter than posterior ones, terminal segment bifurcate. Pronotum less densely punctate than in female and more cupreous; side margins evenly, arcuately, rounded, widest about the middle. Elytra as in the female except for a brilliant cupreous tinge. Beneath as in female except for last ventral segment which is distinctly, obtusely emarginate.

Length 11.5 mm., width 5 mm.

Allotype male in the author's collection, one male paratype in the collection of Mr. R. P. Allen. Collected at the same locality as holotype.

This distinct species belongs definitely in Horn's group VIII and within the group is most closely allied to *atrifasciata* and *ulkei*. It differs from these species by the deeper, more densely punctate head, pronotum and elytra, the absence of the three black fasciae which are, however, represented in the female paratype by one obscure apical and subapical dark spot in the middle of each elytron, and the green color of the undersurface. From *platti* this species can be separated by the lack of sericeousness, the robust shape, the emarginate clypeus, the more deeply and densely punctate head, pronotum and elytra, the bipectinate antennae of the male, the enlarged antennae of the female, and the acute tooth on the anterior femur. From *socialis* (Arizona) *alleni* can be distinguished by its much deeper, more dense sculp-

turing throughout, lack of elytral dark spots, by the front margin of clypeus which is obtusely emarginate rather than deeply sinuate as in *socialis,* lack of frontal impressions on head, rounded rather than subparallel side margins of pronotum, by having the pronotum as wide as humeri of elytra, more convex beneath, tooth on the front femur more acute and by the lack of the lateral projections on the apical margin of the last abdominal segment.

The genus *Knowltonia* was described by Fisher (Proc. Ent. Soc. Wash., vol. 37, June 1935, pp. 117-118) to include what he though was the only known buprestid having biramose antennae. This, however, was not the case as Horn in his revision (1886) described the male of *Chrysobothris atrifasciata* which also has biramose antennae. Inasmuch as several species of *Chrysobothris,* that do not have the male antennae biramose (*prasina, platti* and possibly *ulkei*), are apparently closely related to *atrifasciata* and *biramosa* in many other characters I think that *Knowltonia* should be regarded as a synonym of *Chrysobothris.* For the present *biramosa* Fisher will have to stand as distinct as I have not been able to study a specimen and there was no comparative discussion given in the original description. It does, however, appear to be closely related to *ulkei* and may possibly be the male of that species. From *alleni* it can be distinguished by its brownish-cupreous color above and beneath, smaller size, male pronotum being widest behind the middle, the less densely rugose pronotum, presence of violaceous black elytral markings (comparison made from original description only).

A NEW SUBSPECIES OF MELITAEA PALLA BOISDUVAL 1852 (Lepidoptera, Nymphalidae)

By John Warren Johnson

In the summer of 1935 the writer collected a few specimens of a species of Genus *Melitaea* at Tuber Canyon Spring in the Panamint Mountains, California. These specimens presented characters that distinguished them from the other *Melitaea* species which have been described. Subsequent comparisons of the Panamint specimens with large numbers of specimens of the other species which occur in California and neighboring states showed the Panamint subspecies to have consistent differences of wing pattern. Additional specimens were secured in the Panamints in the summer of 1937 in the same locality, these specimens bearing out the differences already noted to exist. The specimens, while showing distinctive differences, likewise show a strong affinity to the variable species *Melitaea palla*, and appears to be a subspecies of the latter which possibly has been differentiated from the parent stock while geographically isolated in the high peaks of the Panamint Range. The subspecies likewise presents characters relating it to *Melitaea acastus*. *Acastus* however, appears to be a variable and not too well characterized species that shows intergradation on the western part of its range with *palla*. This relationship of *acastus* to the *palla* subspecies complex is further strengthened by the discovery of the Panamint subspecies, whose characters in some respects are intermediate between those of *acastus* and *palla*. The Panamint subspecies is characterized as follows:

Melitaea palla vallis-mortis subsp. nov.

Male:

Wingspread averaging 41 mm.

Superior Surface:

Primaries: Pattern resembling that of *palla*, a composite of rows of orange-fulvous spots separated by black lines; orange-fulvous lighter and less ruddy than in *palla*, resembling but slightly lighter than *acastus;* the fulvous spots defined by the black into regular sinuous rows, presenting a banded effect. Intervening black lines broader, heavier than in *palla* or *acastus;*

the third or median fulvous band (counting proximally from outer margin) being broadest, forming a distinct irregular band across the wing.

Secondaries: Pattern similar to that of *palla* and *acastus,* of tint of primaries. Black lines between the rows of fulvous spots heavier than in *palla* or *acastus.*

Inferior Surface:

Primaries: Lighter fulvous than in *palla* or *acastus.* Marginal lunules creamy white anteriorly, shading into fulvous posteriorly. Six or seven black spots forming an irregular median row across the wing, the most posterior forming a large black patch, as in *palla.*

Secondaries: Light cream, divided into rows of creamy spots by narrow black lines. Marginal lunules creamy, unsilvered; the row internal to the marginal lunules of eight spots, the third to the seventh each largely filled by a round orange spot; the orange spots not as large or bright as in palla, but larger than noted in Edward's description of *acastus.* The orange spots with a few black scales near their outer margins, thus eccentrically somewhat pupillated. The row of fulvous spots crossing the cell from costal to anal margin reduced and of light tint as in *acastus.*

Size relations: The males average 41 millimeters in wing-spread, being thus distinctly larger than *palla* or *acastus.* Fore-wings are more elongate, more produced apically than in *palla* or *acastus.*

FEMALE:

Size: Of very large size, surpassing *acastus* or *palla* females, expanding 51 mm. in both examples.

Superior Surface:

Primaries: Pattern similar to male, the spots orange-fulvous, the first and median rows being light fulvous, the second brighter, more orange fulvous. Edwards notes a similar coloration for *acastus,* although *acastus* seem more frequently to be yellow or yellow-fulvous. Fulvous spots separated by heavy fuscous lines into well-defined band-like rows, rows more regular than in *palla* or *acastus,* fuscous markings heavier than in *acastus.*

Secondaries: Likewise of light fulvous, similar in pattern to male, row of spots internal to marginal lunules darker fulvous, contrasting with the first and median lighter fulvous rows. Rows of spots regular, well-defined by heavy fuscous lines.

Inferior Surface:

Primaries: Similar to male, but lighter fulvous. A series of cream spots extending across the wing just distal to the median row of seven black spots. These cream spots continuous distally with the fulvous of the nervule interspaces. Cell cream, with two orange fulvous discocellar patches. General maculation much lighter and less contrasting than in *palla.*

Secondaries: As in male, of cream color, the first row of spots internal to the marginal lunules more buff, the orange ocelli much reduced. The row of fulvous spots crossing the cell from costal to anal margins almost obliterated and supplanted by cream. The secondaries much paler than in *palla* by the great reduction of the fulvous areas.

A summary of the characters of the Panamint species shows it to be related both to *palla* and *acastus.* It is to be distinguished, however, by its large size, the more regular rows of fulvous spots, the distinct fuscous or black lines between these rows, and particularly the heavy black medial band of the superior surface of the primaries. The undersurfaces are constantly cream, differing thus from *acastus,* which is frequently silvery-white.

Holotype male: Wing expanse 41 mm. Collected June 13, 1935, Tuber Canyon, Panamint Mountains, elevation 8,000 feet, Death Valley National Monument, California.

Allotype female: Wing expanse 51 mm. Collected June 13, 1935, at Tuber Canyon, Panamint Mountains, elevation 8,000 feet, Death Valley National Monument, California.

Paratypes 1-6 same date and place. Paratypes 7-12, Tuber Canyon, June 18, 1937. Paratype 13, Telescope Peak, June 19, 1937. Paratypes 14-20, Tuber Canyon and Baldy Peak, June 18-19, 1937, in the collection of William Hovanitz, Berkeley, California.

Holotype and allotype deposited in the collection of the Los Angeles County Museum. Two paratypes in the collection of the California Academy of Sciences at San Francisco. Remaining paratypes in the collection of the author and Mr. Hovanitz. Because of its distribution in the high mountains of the Death Valley region, the butterfly may well be named *Melitae palla vallismortis*—the Death Valley race of *Melitaea palla.*

NOTES ON CATOCALA PIATRIX RACE DIONYZA HY. EDW. AND SAMIA GLOVERI STRECKER IN CALIFORNIA
(Lepidoptera, Noctuidae and Saturniidae)

By John Warren Johnson

Four years ago it was the good fortune of the writer to obtain for his collection two specimens of *Catocala piatrix* race *dionyza* Hy. Edw., which had been captured by children in Whittier, California. These specimens, male and female, were captured in August, 1933, and September 12, 1933, respectively. The specimens, badly battered though they were, were sent to Dr. A. E. Brower of Bar Harbor, Maine, for identification. Dr. Brower, after inspection of the specimens, wrote in reply that they constituted a new *Catocala* species record for California, as in so far as he knew, it was the first occasion that *Catocala piatrix* or its forms had been collected in this state. The male specimen was retained in Dr. Brower's collection, the female being returned to the writer.

The two Whittier captures, however, are not the first specimens to be taken in California. To the writer's knowledge there now exist eight specimens which have been collected in the state. It seems desirable, therefore, to provide written record of these by listing the data concerning their capture, together with any additional notes that are available.

One collected at Pasadena, 9/14/1913 by F. Grinnell, now in the Los Angeles County Museum collections.

One collected at Los Angeles, 9/15/no year, or collector, in the Los Angeles County Museum.

One collected at Orange County Park in the early 1920's, about 1922, by Messers Carl and Erich Walter. This moth yielded many fertile eggs, but efforts to feed the larvae were unsuccessful.

One collected dead under a tree in Orange, by Mr. Hower, and in his collection.

One male collected at Whittier, 8/-/1933, no collector, in collection of Dr. A. E. Brower, Bar Harbor, Maine.

One female collected at Whittier, 9/12/1933, no collector, in collection of J. W. Johnson, Fullerton.

One pupa collected near Mt. Washington in Los Angeles, 6/-/1934; pupa hatched in July; collector, Miss Alice Betzold.

One collected from Bouqet Canyon, Los Angeles County, 8/6/1937, by Dr. John A. Comstock, in collection of the Los Angeles County Museum.

From these records it is apparent that this species, formerly collected only as far west as Arizona, is also well established as a rare but very real part of the California lepidopterous fauna. One may expect that collecting in the future will reveal more facts concerning the habits, distribution, and numbers of the species in California.

Another species which apparently has not been noted previously as occurring within the state is *Samia gloveri* Strecker. In the summer of 1937 the author was given a male specimen of this species which had been captured at the lights of the Mountain View Camp, Lone Pine, California, by Mr. and Mrs. B. C. King during the spring months of 1937, probably April. Dr. Comstock, in answer to inquiry concerning this record, states that the Los Angeles Museum has "only one specimen in our collection of *Platysamia gloveri* taken in California. This is an example collected by George Willett in Wyman Canyon, White Mountains, California, on May 10, 1934. It is a large female and does not differ in any particular, so far as I can see, from specimens received from Salt Lake City, Utah." The Lone Pine specimen likewise shows no difference in coloration from those of the Great Basin States. Thus from these records *Samia gloveri* may also be placed on the list of the Lepidoptera of California.

The writer is indebted to and wishes to thank Dr. John A. Comstock for the information regarding the records of the first, second, and eighth specimens of *Catocala piatrix dionyza* as listed above, and for the record of *Samia gloveri*.

VARIATION IN HABRODAIS GRUNUS (BOISDUVAL) (Lepid.: Lycaenidae)

By Wm. D. Field
University of Kansas

Habrodais grunus (Bdv.) displays a considerable amount of geographical variation. It is unfortunately one of those species collected by M. Lorquin for Boisduval, the specimens of which were not marked as to locality. We have a very good clew in the preface of Boisduval's "Lépidopterès de la Californie" that helps to ascertain the general region from which this species was first obtained. Boisduval says:[1]

"A naturalist known widely through his zeal and his love of science, M. Lorquin, seduced like the others by this brilliant mirage, embarked also for California, with the purpose of remaking a fortune of which he had been so unworthily stripped. He left in 1849 with his heart filled with hope, believing that in this el dorado it was only necessary, so to speak, to stoop to pick up gold nuggets.

"Once on the ground, without allowing himself any rest, he hastened to devote himself to the placer claims, worked as a digger, with as much courage as energy, finding from time to time some pieces of the precious metal, but the gain which he derived from it after heavy toiling was insufficient for him to procure the things most indispensable to life, in a country wherein everything was at a fabulous price: thirty francs for a dozen eggs! And the rest in proportion.

"Scarcely knowing which way to turn, he girded himself against adversity, left the placers, returned to San Francisco, and putting all personal feeling aside, he did like many others; he practiced various employments quite apart from his habit, which permitted him to live and to make a little money. From this moment dates the honorable position he has acquired today by force of economy, work and perseverance.

"Become freer of his time and having with him his family which had come to rejoin him, he felt the love of natural sciences and especially of entomology reawaken within him. In order to devote himself to his liking, he did not fear to suffer fearsome privations and great fatigues: he explored at first all the environs of San Francisco, then the borders of the Sacra-

[1] Translated from the original French by M. E. Griffith, Univ. of Kan., Lawrence, Kan.

mento and of the Feather Rivers, made trips in the chain of the Sierra-Nevada Mountains and adventured even in the forests of the interior, braving the jaws of bears and the fangs of rattlesnakes.

"These dangerous excursions made during two years in diverse seasons furnished him with some good insect collections, of which he sent us eighteen years ago two very remarkable series. A large part of the Lepidoptera being unknown and entirely new, we published their descriptions in the Annals of the Entomological Society of France,[2] in the form of a small local fauna. Since this period, the zeal of M. Lorquin did not diminish, on the contrary, having more leisure, he undertook journeys into some unexplored regions: he visited the northern mountains, penetrated much farther in the east and made his way later among the Apaches as far as Los Angeles in Sonora. The result of the collections made in these diverse parts of California fully justified that which might be expected of a man such as M. Lorquin. This indefatigable entomologist sent us three successive series of specimens collected in these different localities, enclosing each time a great number of new forms of which the figure surpasses that of the species which we have made known in the faunal note mentioned above." The species taken on these later journeys were published in the paper from which the above quotation is taken, "Annales de la Société Entomologique de Belgique," vol. XII, pages 8-94, 1869.

The original description of *Habrodais grunus* appears on page 289 of the first work mentioned. This eliminates as the type locality the localities collected by Lorquin in his second series of journeys. The possible localities then that Lorquin may have taken the type series in are: San Francisco, the borders of the Sacramento and of the Feather rivers or some locality in the Sierra-Nevada mountains such as Plumas, Sierra, Nevada or perhaps Placer counties. Since the food plant of *grunus* (*Quercus chrysolepis* Liebm.) does not grow in the floor of these river valleys we may safely assume that *grunus* does not fly there. Further I have no records of *grunus* having been taken there. Specimens from any of the Sierra-Nevada counties are of the same subspecies so that we have to decide whether Lorquin's specimens came from near San Francisco or from the Sierra-Nevada Mountains.

A translation of the original description of *grunus* would read as follows: "Wings above fuscous, blending toward the disc fulvescent; underneath a whitish yellow, obsolescent, slightly wavy line, placed in the middle; two obsolete yellow lunules at the rear. This species, of which we only know the females in fairly poor condition is distinguished from our European species by the surfaces. The shape of *quercus*. The top of the

[2] 2nd series, vol. x, pages 275-325, 1852.

wings brown with the disc of a dull reddish, especially on the inferiors. Underneath pale yellowish crossed a little beyond the middle by a sinuous line, not very distinct and ferruginous red. The anal part of the secondaries marked to the right and to the left of the tail by a little lunular reddish yellow obsolete crescent, capped by a blackish crescent. Mr. Lorquin only found three individual females which seems to indicate that this species was passed when he went through the district."

Comparing a series of *grunus* from Contra Costa County, which is near San Francisco, with a series from Nevada County, and both of these with the above description, indicates that the types are from the Sierra-Nevada Mountains. It should be remembered that Boisduval's description is based on badly worn material; nevertheless there are statements in this description that are helpful. In a large series of specimens from Mt. Diablo, Contra Costa County, all but a very few specimens have a well defined marginal row of crescents on the underside of the secondaries. These crescents are black, faintly outlined on the inner side by blue. In specimens from Donner Lake, Nevada County, the crescents near the anal angle are usually the only ones remaining, the others are completely gone or only very faintly indicated. Boisduval only mentions those near the anal angle. He also says that the sinuous line placed in the middle of the wings underneath is not very distinct. Specimens from Nevada County show a far less distinct sinuous line in this area than specimens from Contra Costa County. Indeed in the latter there is a very distinct "ferruginous red" sinuous line, this line being made more apparent by whitish-yellow along its outer side in the great majority of specimens. These comparisons indicate that Boisduval's types came from the Sierra-Nevada Mountains.

Mr. Charles Oberthür gives an illustration of *grunus* from the Boisduval collection in figure 1923, Pl. CCXXXV of his "Études de Lépidoptérologie Comparée." This figure cannot be of one of the original type specimens as it does not agree with the above description in two important characters. His figure lacks the "little lunular reddish yellow obsolete crescent capped by a blackish crescent." This reddish yellow spot is of minor value in setting aside a subspecies but is valuable in identifying a particular specimen. Individual specimens may or may not have this spot. The original specimens had on the upper surfaces "a disc of dull reddish, especially on the inferiors." This does not agree with Oberthür's figure; however his figure does agree perfectly with Boisduval's second description of *grunus* published some seventeen years later. Oberthür's figure then represents a metatype of Boisduval's but not a specimen from the original series.

M. Lorquin later collected specimens of *grunus* probably in southern California and upon receiving these Boisduval re-

described the species in his second paper on Californian butterflies. This description which appears on page 45 of his "Lépidoptères de la Californie" published in the "Annales de la Société Entomologique de Belgique," vol. XII, 1869, is translated as follows: "We had not seen this species except in very bad condition. We have since received absolutely perfect individuals of the two sexes which permit us to rectify our description. On the top it is of a ferruginous red-brown with the extremities copiously blackish especially in the male. The underside of the fore wings is entirely of a yellow ochre. The underside of the hind wings present a series of little bluish crescents edged with black toward the rear and preceded by a little sinuous whitish indefinite line. Our first description made on a poor specimen is entirely incorrect with respect to the underside of the lower wings."

This description agrees very well with specimens from the San Jacinto Mountains. These latter are identical with specimens from the Sierra-Nevada Mountains and both represent typical *grunus*. With the discovery of two new subspecies and because of the briefness of Boisduval's descriptions it seems advisable to give a complete description of typical *grunus* along with the description of the new subspecies.

Habrodais grunus grunus Boisduval

Size: These measurements are taken by measuring the number of millimeters between the inner angle of one of the fore wings and the vertex of the same wing. The smallest male measured 15 mm., the largest 16 mm. The smallest female 16 and the largest 17. The average female wing length was 16.5 and that of the male 15.6. The average wing length of all specimens of both sexes was 16 mm.

Upper surfaces: Ground color dark brown becoming gradually darker toward the vertex of the primaries and toward the outer margin of the secondaries. The disc of the primaries is orange brown. This same color is faintly indicated on the secondaries. There is a median streak of orange brown on the tail.

Under surfaces: Ground color light ochre, a sinuous mesial band of a darker brown running through the entire width of the secondaries and through the anterior two-thirds of the primaries. This band is outlined on the outer side by a thin, inconspicuous line of white which in a very small percent of the specimens (10%) is nearly eradicated by the ground color. A fraction over a millimeter in from the exterior margins of the secondaries there is an internerval row of small black crescents capped with blue. These crescents are well defined near the anal angle and are only faintly indicated in the rest of the row. Indeed, in eightly percent of the specimens of typical *grunus*

before me these crescents are almost completely gone except in the anal area. At the end of the cell in both primaries and secondaries there is a faint light bar faintly outlined on both sides by a brown line, about the same color as the mesial line. In eightly percent of the specimens the crescent above the tail has inside a small black or reddish point. The area immediately around this point and between it and the crescent is faintly orange. The females of typical *grunus* hardly differ from the males. They seem to have a mesial band that is a trifle more distinct with perhaps a little more white on the outside of that band.

Note: I have examined specimens of this subspecies from the following localities: Pass west of Donner Lake, Nevada Co., California, July 31, 1935, elevation 6,600 ft., collectors H. H. Brown and F. M. Brown; Placer Co., California, July 12, 1899; Yosemite National Park; Twin Falls, Idaho, June 28, 1930; Idylwild, San Jacinto Mountains, California, July 30, 1933, collector L. Hulbirt; same locality various dates in July, 1936, collectors, R. H. Beamer, J. D. Beamer, M. Jackson and W. D. Field; Camp Baldy, San Bernardino Co., California, August 9, 1927, collector J. S. Garth; various dates from the San Gabriel Mts., California, and from Sheep Canyon, San Bernardino Mts., California.

Habrodais grunus lorquini subsp. nov.

Size: Smallest male 15 mm., largest male 16 mm. Smallest female 14 mm., largest female 16 mm. The average length of anterior wings in male and in female is 15.46 and 15.20 mm., respectively. The average of both sexes is 15.33.

Upper surfaces: Ground color a little darker than in *grunus grunus* with a more reduced disc.

Under surfaces: Ground color of a darker ochre than in *grunus grunus.* The sinuous mesial band is a little wider and of a much darker brown than in typical *grunus,* and much more conspicuous. The light outline is more evident. The marginal row of crescents have less blue outlining them toward the inside of the wing. This row is well defined throughout the border of the wing in the majority of the specimens. In some specimens this row is reduced to mere points or is partially missing. The faint light bar outlined by brown in typical *grunus* is here about the same color as the ground color, outlined more distinctly by brown which is again the same brown as that of the mesial band. The small black point and the surrounding orange within the crescent above the tail is absent except in about twenty-five percent of the specimens. The females differ by being of a slightly lighter ground color.

Note: Two specimens from Mt. Diablo and two from Santa Cruz, California, differ from typical *lorquini* in being

brown instead of ochraceous underneath. Five specimens from Mt. Diablo have the sinuous mesial band on the underside of the wings entirely or almost entirely missing.

Data: Holotype ♂ and allotype ♀, Mt. Diablo, Contra Costa Co., California, August 1, 1932. Eleven ♂ and two ♀ paratypes, same locality and date. Two ♀ paratypes, Trinity Co., California, July 5, 1931. These types in the collection of F. Martin Brown, Colorado Springs, Colorado. Eight ♂ and two ♀ paratypes, Santa Cruz, California, July 20, 1935, collector J. W. Tilden. One ♂ paratype, Santa Cruz, California, July 21, 1932, J. W. Tilden. These types in the collections of the author and of J. W. Tilden.

HABRODAIS GRUNUS LORQUINI nov. f. CHLORIS

Size: Smallest male 12:5 mm., largest male 15 mm. Smallest female 13 mm., largest female 15 mm.. Average length of anterior wings in male 13.67 mm. and in the female 14.36 mm. The average of both sexes is 14.01 mm.

Upper surfaces: Ground color much darker than in typical *grunus,* with a greatly reduced disc. The orange brown color of the disc is greatly suffused with blackish.

Under surfaces: Male: Ground color in the majority of specimens of a very light ochre. In a few specimens this ochre becomes the same dark ochre as in typical *lorquini.* In the great majority of specimens the mesial band is broken up and is not as wide or as distinct as in typical *grunus lorquini.* In about fifty percent of the specimens the marginal row of crescents is a little blacker, with even less blue than in the second brood of *lorquini* (late summer material). In the remaining fifty percent this band is only faintly indicated. In this character the first brood seems to be bridging the second brood of the coastal race with the inland race. The bar at the end of the cell is much fainter than in either *grunus lorquini* or *grunus grunus.* The same black point that is present in about eighty percent of typical *grunus* and in about twenty-five percent of *grunus lorquini* is present in only twenty percent of the specimens of this spring form of *lorquini.* Female: Differs from the male in being of a much lighter, almost whitish ochre ground color.

Data: Holotype and allotype, ♂ and ♀, Mt. Diablo, Contra Costa Co., California, June 17, 1931. Thirty-three ♂ and eleven ♀ paratypes, same locality, June 16-17, 1931. One pair of paratypes in the collection of the Los Angeles Museum and one pair in the author's collection. The rest in the collection of F. M. Brown, Colorado Springs, Colorado.

Note: Mr. J. W. Tilden is of the opinion that *grunus* is not double brooded. He says in a personal note to the writer,

"This species is always found in connection with the varieties of golden oak (*Q. chrysolepis*), and is as far as I know, single brooded. At least, I have never collected where *Habrodais* was double brooded." The specimens I have from Mr. Tilden are specimens taken late in July near Santa Cruz. The species may be single brooded there. However, Contra Costa County material, as well as that from Los Angeles County seem to divide into two broods according to the dates of collection, one in June and the other in late July or early August. If all of the subspecies of *grunus* are single brooded then there is certainly a long period of flight and of emergence. At any rate *lorquini* is separable into two forms, a spring and a summer form, by the characters given above. Apparently there is no difference in color pattern between the two broods or between the two extremes of the long period of flight, whichever it is, of typical *grunus grunus*.

Habrodais grunus herri nov. subsp.

Size: Length of anterior wing 17 mm.

Upper surfaces: Disc of the fore wings greatly extended and light yellowish in color. The margin narrower than in typical *grunus* and sharply defined by the light yellow color of the disc. The margin is the same dark brown color present in typical *grunus*. Secondaries similar to primaries except that the dark brown color of the margin is present in the base of the wing and scattered lightly over the light yellow colored disc.

Under surfaces: Ground color a little brighter than in typical *grunus*. All markings are very faint, almost obliterated.

Data: Holotype ♂, McKenzie (Sister's) Pass, Oregon, August 28, 1936, collector C. W. Herr. One ♂ paratype, same locality and date. One ♂ paratype, same locality, September 1, 1936. All types in the author's collection.

NOTES ON THE METAMORPHOSIS OF MITOURA SPINETORUM HEW.
(Lepidoptera, Theclinae)

By John A. Comstock and Charles M. Dammers

The Thicket Hairstreak, *Mitoura spinetorum* Hew. is one of the rarer western butterflies which has persistently eluded the efforts of lepidopterists to learn anything concerning its early stages. The following incomplete record has been made possible through the helpful coöperation of several local workers.

Mr. T. W. Hower obtained a female in Lytle Creek, San Bernardino Co., Calif., early in July, 1936, from which five eggs were secured. One of these was turned over to us.

Mr. Chris Henne collected a full-grown larva on Pine Mistletoe in the Greenhorn Mountains, Kern County, Calif., on July 19, 1936, and he also furnished us with a larva and pupa which he had collected in the San Bernardino Mountains, July 28, 1937.

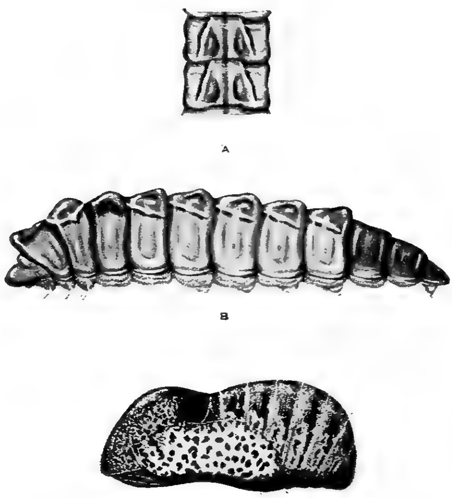


PLATE 3

Larva and pupa of *Mitoura spinetorum*, enlarged approximately x 3.

A. Two typical segments of larva, viewed dorsally.

B. Lateral aspect of mature larva.

C. Pupa, dorsal aspect.

Reproduced from painting by Comm. Charles M. Dammers

The egg is of the usual Lycaenid type, echinoid in shape, with a reticulation of raised walls covering the surface. These raised reticulations do not have spiculiferous processes arising from their junctures as is the case with many of the eggs of species in this genus.

Mature Larva. Length, extended, 19 mm.

Characteristically slug-shaped, the surface smooth and the segments thrown into ridges and folds, as indicated in the two illustrations, Plates 3 and 4.

PLATE 4
Mature larva of *Mitoura spinetorum*, viewed dorsally. Enlarged x 3.

Body ground color, pale yellow-olive. A narrow pale olive band runs mid-dorsally. Sub-dorsally on the third, and fifth to ninth segments there occurs an oblique soiled white bar. That on the third has a point in its center. The lower edges of these bars are tinged with dark magenta, and above each bar is a large raised orange patch shading off to magenta on its upper edge. These orange patches are present on the fifth to ninth segments.

Subdorsally on the second segment there is a narrow magenta band. Likewise subdorsally on the fourth segment there is a broad dark olive band shaded with magenta on the middle portion of its upper edge.

Segments ten to twelve have a mauve shading over the back and sides above the infra-stigmatal fold.

Spiracles, pink, with brown rims. Infra-stigmatal fold bright orange, tinged above and below at the rear end of each segment with dark magenta.

Legs, yellow-olive, with pale brown points. Prolegs, yellow-olive with flesh colored claspers.

Cervical shield, pale mauve, divided down its center with a pale olive bar, and speckled with brown.

Head, pale chestnut; mouth parts dark chestnut. Ocelli, black.

Abdomen, yellow-olive, covered with short colorless hairs. This is the only part of the larva that has apparently any hairy vestiture, at least under ordinary magnifications.

Pupation took place in late July with the examples that we had under observation. The site of pupation was in a mass of foodplant, and no silken attachment was observed.

PUPA. Length, 11 mm.

Color, dark chestnut, with a suggestion of olive over the wing cases. The entire surface is mottled with black, which is noticeably heavy along the mid-dorsal line.

Spiracles, soiled white.

Prothorax, thorax and body densely covered with minute short dark brown hairs.

Our figure C of Plate 3 correctly portrays the shape of the chrysalis.

Our description of the larval colors and markings might lead to the conclusion that the caterpillar was a rather brilliant object. As a matter of fact its form and color are a camouflage as they blend perfectly with the coloration of the food plant, Pine mistletoe (*Arceuthobium campylopodum* Engelm.).

A NEW RACE OF EUPROSERPINUS PHAETON FROM THE MOJAVE DESERT (Lepidoptera: Sphingidae)

By John Adams Comstock

Typical *Euproserpinus phaeton* G. & R., occurs in several areas of California west of the Sierran and Southern Sierran ranges, having been recorded from as far north as Atascadero, and south into Baja California. We have numerous examples from Mason Valley, San Diego County, and from the Gavilan Hills, Riverside County.

For the past three years we have been taking a *Euproserpinus* on the Mohave Desert which shows constant differences from the typical form. Feeling that it deserved at least a racial name has led us to a somewhat extensive study of the group with the following results and conclusions:

There are three names which we have to consider in this genus, i.e.:

E. phaeton Grote and Robinson, Proc. Ent. Soc. Phila., V, 179, 1865;

E. erato Boisduval, Ann. Soc. Ent. Belg., XII, p. 95, 1868;

E. euterpe Henry Edwards, Ent. Amer. IV, p. 25, 1888.

The original material from which both *phaeton* and *erato* were named was taken by M. Pierre Lorquin on his later southerly excursions in which (to quote Dr. Boisduval) he "penetrated much farther in the east and made his way later among the Apaches as far as Los Angeles in Sonora." We of course know that Lorquin did not get into the territory of the true Apaches, but in all probability used the name familiar to the southern overland emigrants as designating the primitive Indian tribes.

The best indication of the southern territories visited by Lorquin lies in the species taken by him at the time, such for example as:

Lycaena regia Bdv. (= Philotes sonorensis Feld.) and

Lycaena evius Bdv. (Plebejus icarioides evius Bdv.).

These, and others which he secured are distinctly southern mountain and coastal species, and do not occur on the Mojave Desert proper.

After considerable correspondence we were able to ascertain that the type of *Euproserpinus phaeton* G. & R. is in the British Museum. Specimens of our local forms were sent to Mr. W. H. Tams of the B. M. Department of Entomology for comparison with this type, and we now learn, through the courtesy of Captain N. D. Riley, Keeper of Entomology at the British Museum, and of Mr. Tams, that our small coastal form (see Plate 7, fig. A) agrees with this type.

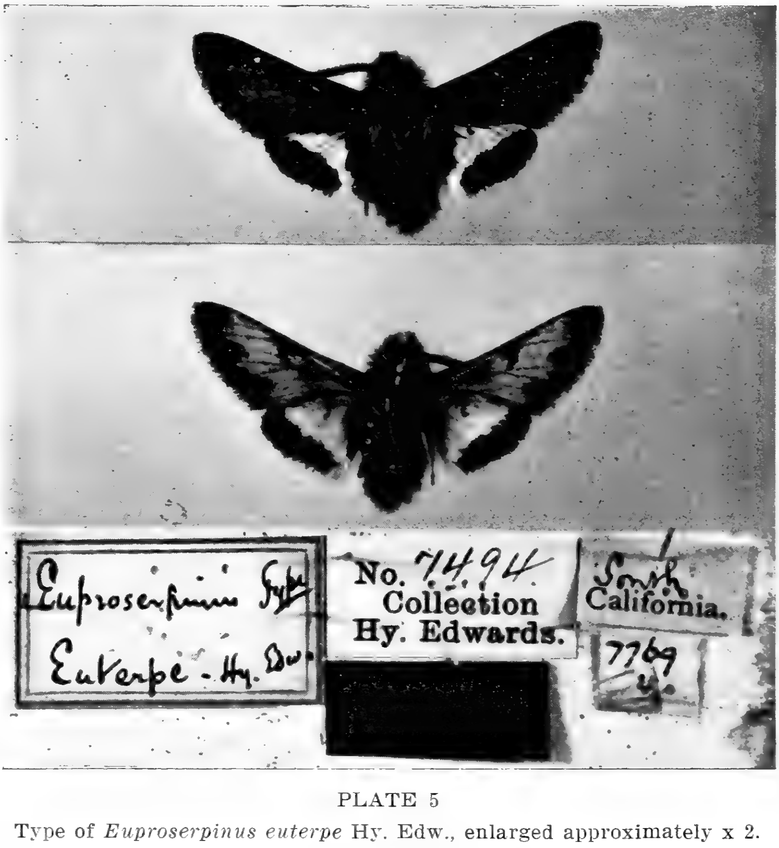


PLATE 5

Type of *Euproserpinus euterpe* Hy. Edw., enlarged approximately x 2.
Upper figure, dorsal surface. Lower figure, ventral surface.
Photo. courtesy Cyril F. dos Passos, and American Museum of Natural History

A B

PLATE 6
Euproserpinus euterpe Hy. Edw. Enlarged approximately x 2.
A. Upper side, ♂. B. Upper side, ♀.
Photo. courtesy B. Preston Clark

A

C

B

D

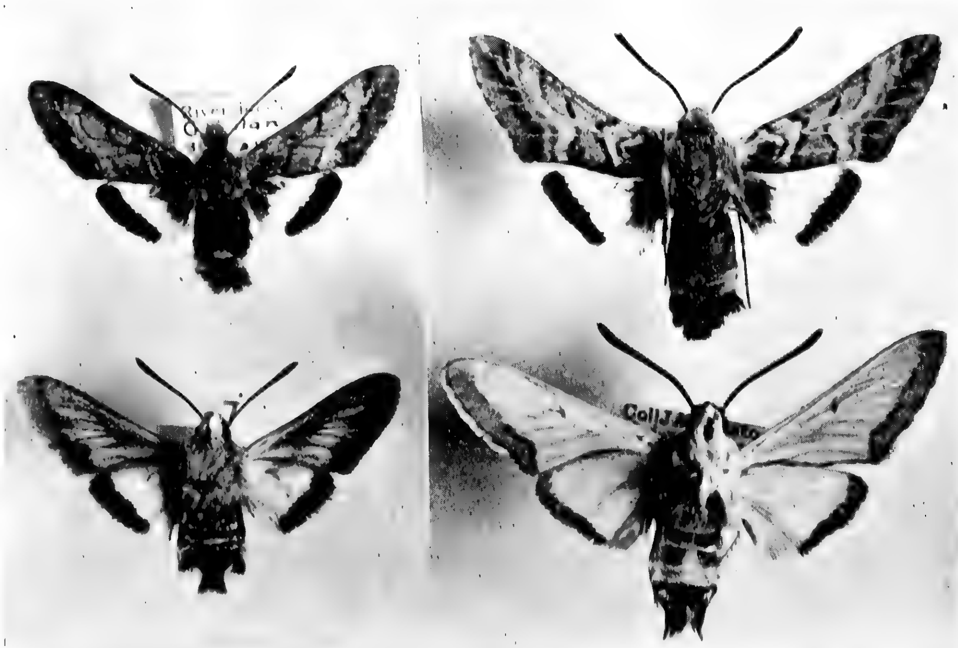


PLATE 7

Figs. A and B—*Euproserpinus phaeton* G. & R. Typical examples. Upper figure, ♀ superior surface. Lower figure, ♀ inferior surface.

Fig. C—*Euproserpinus phaeton mojave* Comst. ♂ paratype No. 2. Upper side.
Fig. D—*E. phaeton mojave* ♂ paratype No. 1. Under side.

All figures enlarged approximately x 1½.

It was hoped that the type of Boisduval's *erato* would be found in the Barnes' collection at Washington, the B. Preston Clark collection, or the British Museum, but it is not located in any of these places. Probably no type was preserved or designated, as all of the early workers were evidently satisfied as to the name being synonymous with *E. phaeton,* or at least as to the two names designating a single species. Strecker's comments[1] in this connection are of interest, and serve to show, as do also Boisduval's remarks[2] that the original type lot served as the basis for both names. Furthermore, Strecker's picture of *E. erato* on his Plate XIV, fig. 1, shows the small coastal form now properly designated *phaeton.*

The third name in the genus, *E. euterpe* Hy. Edw., is unquestionably a valid species. The type is in the American Museum of Natural History collection, New York City, and was very kindly photographed for us by Cyril F. dos Passos. We also have an excellent photograph, furnished through the courtesy of Mr. B. Preston Clark showing a ♂ and ♀ of *E. euterpe* from the Clark collection. This is reproduced on Plate 6. Mr. Clark points out the following differentiation:

> "*E. phaeton.* ♂ antennae black throughout, enlarged towards apex.
>
> ♀ antennae black throughout, enlarged toward apex.
>
> *E. euterpe.* ♂ antennae main stem white above, black beneath. Main stem even in width, not tapering at all, except at extreme tip.
>
> Each lateral segment has a tuft of 8-10 dark colored bristles, parallel to each other. There are about thirty segments. Antennae are different from any Sphingid which I have examined.
>
> ♀ antennae brown throughout, enlarged but very slightly at tip. Slenderer than in *phaeton.*"

"One difference which the photographs only partially show is that while in *phaeton* the black and white areas of the forewing are sharply contrasted, in *euterpe* the most of the wing is grey, light or dark."

Mr. Clark might also have pointed out the rather marked difference in the shape of the forewing, which in *euterpe* shows

[1] Lepid. Rhopal. & Heteroc. H. Strecker., p. 133 footnote, and p. 125.
[2] Suites a Buffon, p. 363, 1874.

an outward curve, making the wing relatively wider in its outer half. There is evidently also a tendency on the primaries for the fringes to be very dark at the ends of the nervules, and lighter between, giving a somewhat checkered appearance, whereas in *phaeton* they are uniformly greyish-black.

Henry Edwards stated that his type was a ♀ but his description, and the photograph of the type itself shows it to have been a ♂. This type was said to have been "captured near San Diego, California, by the late H. K. Morrison." If this locality is correct, we fear that the species is now extinct, as we have examined scores of Euproserpinus taken of late years in San Diego County, and have yet to see a *euterpe*. There is, of course, a possibility that Morrison was in error as regards the locality label attached to his specimen.

Our Mojave Desert race can readily be separated from typical *phaeton,* and thus far we have found no territory in which intergrades occur. We designate this race as follows:

Euproserpinus phaeton r. **mojave** race nov.

Of the same general shape as *Euproserpinus phaeton* G. & R., but averaging slightly larger in expanse, and with secondaries relatively a little longer antero-posteriorly. The general color of the upper side of primaries is much whiter on the average than in *phaeton,* due to a greater abundance of white scales particularly in the discal area of the wing. The veins in this area are practically free of black scaling, whereas in *phaeton* they are distinctly, though narrowly scaled. The dark marginal band is proportionately somewhat narrower and is slightly lighter in color than it is in the typical form. The fringes are edged with white, whereas in *phaeton* they are, in nearly all examples, mottled blackish-brown.

The under side of primaries is markedly different in this race, and serves at once to differentiate it. The entire wing, except for a narrow marginal band, and a spot at the outer angle of the discal cell, is glistening white, whereas in *phaeton* the costal margin, much of the discal cell, and most of the veins are heavily powdered with black. In *phaeton* the wide marginal band is very dark and distinct, and its inner margin is dentate or wavy whereas in this new race this marginal band is narrow, and dusted over with white scales giving it a gray cast, and its inner margin is usually parallel with the outer for most of its distance. The fringes are white on their outer margins whereas they are usually quite dark in typical *phaeton.*

The secondaries differ principally in having a relatively narrower black marginal band, particularly on the under side.

a b

PLATE 8

Mature larva of *E. phaeton mojave* Comst., feeding on stems of primrose. *a.* Lateral view. *b.* Dorsal view. Photo enlarged x 2.

The crown of the head anterior to the point of origin of the antennae bears an abundance of long white hairlike scales, mixed with some that are dark. The color of this part is much lighter than in typical *phaeton*. There is also a greater preponderance of white hair on the under surface of thorax and abdomen, as will be noted by referring to Plate 7, fig. D.

Holotype ♂. Yermo, Mojave Desert, Calif., April, 1935. Expanse of wings, 37.5 mm.

Allotype ♀, Adelanto, Mojave Desert, Calif., April 11, 1937, Coll. by R. H. Andrews and Lloyd M. Martin. Expanse, 36 mm.

A series of paratypes as follows: 12 ♂♂, 18 ♀♀. Paratype No. 1, near Yermo, Mojave Desert, Calif., April, 1935. All other paratypes from Yermo, Llano or Little Rock, on the Mojave Desert, the dates ranging from March to April of the years 1932 to 1938. The five reared specimens in the type series however emerged earlier—three in January, 1938, and two in February, 1938.

The holotype and a ♀ paratype will be placed in the B. Preston Clark collection. We feel that this is more than justi-

fied in view of the great importance of this magnificent assemblage of Sphinx moths, and the fact that they are destined ultimately to be a part of the Carnegie Museum collection.

Paratypes will be placed in the National Museum, Washington; the British Museum, London; the Canadian National Museum, Ottawa; the California Academy of Sciences, San Francisco, and the San Diego Museum of Natural History.

The allotype, and all remaining paratypes will remain in the collection of the Los Angeles Museum.

The larva of this subspecies feeds on *Oenothera dentata* var Parishii (Abrams) Munz. Determination of the plant was kindly made for us by Prof. Philip A. Munz.

In the spring of 1937 we were able to collect about a hundred and fifty larvae, thanks to the coöperation of Robert Andrews, Lloyd Martin and other members of the Lorquin Entomological Society. These were in various stages of growth, and proved exceedingly difficult to raise. The rate of mortality among the larvae was high, and a heavy loss occurred at the time of pupation. Only five examples were brought to maturity, although several hatched and failed to expand their wings.

A few chrysalids show signs of carrying over into a second year at the present writing.

The following notes will serve to supplement the description of the larva and pupa of the parent species, *E. phaeton*, which Commander Dammers and the author jointly published in the "Bulletin So. Calif. Acad. of Sciences," Vol. 33, No. 3, p. 141, 1934. Apparently there is little or no difference between the larvae of the two forms, although we were unable to make accurate comparisons, not having the larvae of both kinds at the same time.

Larva of 11.4 mm. length measured on April 25, 1937.

Head width, 1.024 mm. Color of head probably pinkish, but nearness to the moult makes this uncertain.

Body, pale green, with a thick sprinkling of white spots over the surface, each bearing a colorless short process with a club-like thickened end.

A delicate longitudinal whitish stripe occurs, placed lateral to the mid-dorsal line. No scutellum is apparent. Caudal horn a short stub, with numerous warty projections, tinged pink. A pink mottling in the scutellar region, and also around the caudal area.

There is a whitish sub-stigmatal line, shaded below with pinkish-maroon. Legs tinged with pink. Prolegs with a pink-maroon shading on the sides. Claspers colorless.

Stigmata yellow, with dark brown narrow circlets.

The larva moulted April 26.

Penultimate instar. Length of larva on April 30, 19 mm.

Head width, 1.80 mm. Color of head, bright pink, studded with whitish dots, each bearing a colorless clubbed process. Ocelli translucent, some tipped with black.

Body color green, studded as before with white spots.

First segment pink. There is a pink or maroon longitudinal band, dorso-laterally placed, external to which runs a white band.

An infra-stigmatal white band occurs, which is interrupted at each segmental juncture, and is shaded above and below with maroon.

Anal end, pink. Legs and anal prolegs pink. Prolegs green, with a pink shading at the tips. Spiracles as before. Caudal horn bright pink.

The moult occurred May 1.

Final instar. Length of larva, measured shortly before it ceased feeding, approximately 40 mm.

Head width, 3 mm. Color of head, dark maroon.

Body, ground color, light green.

In the mid-dorsal line there is a row of dark brown triangular spots, one situated at each segmental juncture. Between these spots a green area, shading into maroon laterally, and terminating abruptly at the edge of a longitudinal yellow line.

There is a dark brown shaded spot lateral to each brown triangle, placed medially to the edge of the yellow line.

Superior to each spiracle is a dark brown quadrate spot, caudal to which is a maroon shading.

A discontinuous maroon band runs longitudinally in the stigmatal area but this is interrupted caudally to each spiracle by a soiled white transverse bar.

Infrastigmatally there runs a wide longitudinal soiled white band.

Abdominal surface, gray-green shading into light pink-maroon laterally.

Legs, maroon with brown tips. Prolegs maroon.

Spiracles, dark yellow centered, with narrow brown rims.

The above description is of the darker type of larva, which is not as common as the type in which green predominates. In the latter the maroon color is much restricted, and its place taken by green.

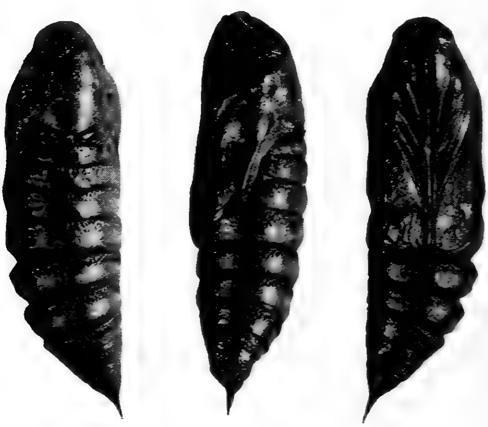
The body is covered by numerous short processes or hairs, arising from soiled yellowish-white spots.

Caudal horn as in previous instar.

This larva pupated May 14.

The mature larva is pictured in Plate 8 and the pupa in Plate 9.

In color the pupa ranges from a soft red-brown to a deep brownish black. The shape is adequately shown in our illustration.



a *b* *c*

PLATE 9
Pupa of *Euph. phaeton mojave* enlarged approximately x 2½.
a. Dorsal aspect. *b*. Lateral aspect. *c*. Ventral aspect

The Southern California Academy of Sciences announces the forthcoming publication of

CHECK LIST OF THE LEPIDOPTERA OF CANADA AND THE UNITED STATES OF AMERICA

Part 1—Macrolepidoptera

By J. McDunnough, Ph.D.

which will be issued as Part 1 of Volume one of its new series of "Memoirs of the Southern California Academy of Sciences."

This publication will be on sale to non-members of the Academy at $4.00. It will be distributed to fully paid Annual Members of the Academy without cost.

It will be impossible for the Academy to distribute this book to individuals or institutions that are now receiving the "Bulletin" on exchange, or to Subscription Members who have subscribed for the Bulletin only.

To those individuals who wish to qualify for full membership in the Academy, the opportunity is presented of receiving the Bulletin for one year, and the McDunnough Check List of the Macrolepidoptera for the first year's membership fee of $5.00.

Additional copies of the Check List will be made available to paid up members only, at $2.00 per copy while the edition lasts.

Bulletin subscribers who have already remitted the $2.00 subscription fee for the year 1938 may, on payment of an additional $3.00, have their names enrolled as Annual Members, and receive the McDunnough List, Part 1, without additional cost.

It is also proposed to issue a limited number of the McDunnough Check List, printed on one side of page only, suitable for writing additional notes. This limited edition will be sold only on advance subscription. Its issuance is contingent on the number of persons evidencing an interest in the proposal.

Address all inquiries to

Dr. John A. Comstock, Treasurer
Southern California Academy of Sciences,
Los Angeles Museum, Exposition Park,
Los Angeles, Calif.

BULLETIN of the SOUTHERN CALIFORNIA
ACADEMY of SCIENCES

Published by the Academy at Los Angeles, California
Subscription—$2.00 per year

Free to Life Members and Unlimited Annual Members
of the Academy (Annual Membership Fee $5.00)

Address all communications to Dr. John A. Comstock

Care of Los Angeles Museum, Exposition Park,

Los Angeles, Calif., U. S. A.

Publications of the

Southern California Academy of Sciences

The Academy has published to date the following:

PROCEEDINGS, 1896 to 1899. Six numbers—Vol. 1, Nos. 1 to 6.

MISCELLANEOUS BULLETINS issued under the imprint of the Agricultural Experiment Station, 1897 to 1907. *Ten numbers.*

All issues of the above are now out of print.

■ ■

Bulletin of the

Southern California Academy of Sciences

Began issue with Vol. 1, No. 1, January, 1902. Issued ten numbers in 1902; nine numbers in 1903, 1904, 1905; three numbers in 1906. Issued two numbers annually from 1907 to 1919, both inclusive (except 1908—one issue only). Issued four numbers (January, May, July and October) in 1920.

The 1921 issues are: Vol. XX, No. 1, April; Vol. XX, No. 2, August; Vol. XX, No. 3, December.

The 1922 issues are: Vol. XXI, No. 1, March; Vol. XXI, No. 2, September.

The 1923 issues are: Vol. XXII, No. 1, March; No. 2, July.

The 1924 issues are: Vol. XXIII, No. 1, January-February; No. 2, March-April; No. 3, May-June; No. 4, July-August; No. 5, September-October; No. 6, November-December.

From 1925 to 1936, including volumes XXIV to XXXV, three numbers were published each year. These were issued as No. 1, January-April; No. 2, May-August; No. 3, September-December, for each volume.

PUBLICATIONS OF THE SOUTHERN CALIFORNIA ACADEMY OF SCIENCES

For Sale at the Appended Prices

BULLETIN:

	To Members	To Non-Members
Complete set, Vols. 1 to 33, bound		$100.00
(Incomplete set) Vols. 8 to 33, bound		80.00
Vol. 3, No. 7, 1904	$ .25	.50
" 4, " 5, 1905	.25	.50
" 6, " 1, 1907 (Photostat only)	2.00	4.00
" 6, " 2, 1907	.25	.50
" 7, " 1, 1908	1.00	2.00
" 8, " 1, 1909	1.00	2.00
" 9, " 1, 1910	2.00	4.00
" 9, " 2, 1910	.75	1.50
" 10, " 1, 1911	1.00	2.00
" 10, " 2, 1911	2.00	4.00
" 11, " 2, 1912	1.00	2.00
" 12, " 1, 1913	1.00	2.00
" 15, " 2, 1916	.75	1.50
" 16, " 2, 1917	1.00	2.00
" 17, " 1, 1918	2.00	4.00
" 17, " 2, 1918	1.50	3.00
" 18, " 2, 1919	2.00	4.00
" 19, " 1, 1920	.50	1.00
" 19, " 4, 1920	.50	1.00
" 20, " 1, 1921	2.00	4.00
" 20, " 2, 1921	2.00	4.00
" 20, " 3, 1921	2.00	4.00
" 21, " 1, 1922	2.00	4.00
" 21, " 2, 1922	1.00	2.00
" 22, " 1, 1923	1.50	3.00
" 22, " 2, 1923	2.00	4.00
" 23, " 1, 2, 3, 4, 5, 6, 1924 (each)	.25	.50
" 24, " 1, 2, 3, 1925 (each)	.25	.50
" 25, " 1, 1926	2.00	4.00
" 25, " 2, 3, 1926 (each)	.25	.50
" 26, " 1, 2, 3, 1927 (each)	.25	.50
" 27, " 1, 2, 3, 1928 (each)	.25	.50
" 28, " 1, 2, 3, 1929 (each)	.25	.50
" 29, " 1, 2, 3, 1930 (each)	.25	.50
" 30, " 1, 2, 3, 1931 (each)	.25	.50
" 31, " 1, 2, 3, 1932 (each)	.25	.50
" 32, " 1, 2, 3, 1933 (each)	.25	.50
" 33, " 1, 2, 3, 1934 (each)	.25	.50
" 34, " 1, 2, 3, 1935 (each)	.25	.50
" 35, " 1, 2, 3, 1936 (each)	.25	.50
" 36, " 1, 2, 3, 1936 (each)	.25	.50

Miscellaneous, Publications of Affiliated or Co-operating Organizations:

Lorquinia—Vols. 1, 2 (all published)...bound $1.50, unbound $1.00

Southern California Geology and Los Angeles Earthquakes, R. T. Hill .... bound 5.00

Southwest Science Bulletin, May 5, 1920 (all published), chiefly Entomological, 1 colored plate 1.00

Check-list of the Recent Bivalve Molluscs (of N. W. Coast of Am. from the Polar Sea to San Diego), W. H. Dall 1.00

(*Continued on next page*)

PUBLICATIONS (*continued*)

Reprints:

Check-list of the Lepidoptera of Boreal America. Superfamilies Sphingoidea, Saturnioidea and Bombycoidea (printed on one side of page only, to allow of additional notes), Wm. Barnes and Foster H. Benjamin, 1927 .... $ .50

The Cacti of the Pyramid Peak Region, Dona Ana County, New Mexico, 1931. F. R. Fosberg .... .25

ADDRESS ALL INQUIRIES TO

SOUTHERN CALIFORNIA ACADEMY OF SCIENCES

(Care DR. JOHN A. COMSTOCK)

Los Angeles Museum, Exposition Park,

Los Angeles, California, U. S. A.

The work of the Southern California Academy of Sciences is carried on entirely through the generosity of private citizens, who are sufficiently interested in the advancement of education and cultural endeavor to donate funds or make bequests to the Academy. As a guide, in the matter of bequests, for those who plan to further this program, the following forms are suggested:

Form of Legacy

To be used when it is desired to leave the Academy any personal property, such as money, stocks, bonds, works of art, or other objects of value.

I give and bequeath unto "Southern California Academy of Sciences," of the City of Los Angeles, the sum of.. Dollars: To have and possess the same unto the said "Southern California Academy of Sciences," its successors and assigns, to the uses, dispositions and benefits thereof forever.

Form of Devise

To be used when it is desired to leave real estate to the Academy.

I give and devise to "Southern California Academy of Sciences" of the City of Los Angeles, (.. here describe the property or ground rent..), together with the appurtenances, in fee simple, and all policies of insurance covering said premises, whether fire, title or otherwise, free from all taxes: To have and to hold the same unto the said "Southern California Academy of Sciences," its successors or assigns forever.

REPRINTS: Contributors of articles accepted for publication in the *Bulletin* should order reprints, if desired, when they return galley proof to the Editor. They may be ordered through the Editor at the following rates, from the McBride Printing Co., 415 East Eleventh Street, Los Angeles, Calif., the contributor paying for all his reprints.

PRICE LIST OF REPRINTS
(WITHOUT COVERS)

	4pp.	8pp.	12pp.	16pp.	20pp.	24pp.	28pp.	32pp.
50 copies	$3.75	$ 5.75	$ 8.50	$10.25	$11.75	$13.50	$16.00	$17.00
100 "	4.50	7.50	10.75	12.75	15.00	17.25	20.25	21.50
150 "	5.25	9.25	13.00	15.25	18.25	21.00	24.50	26.00
200 "	6.00	11.00	15.25	17.75	21.50	24.75	28.75	30.50
250 "	6.75	12.75	17.50	20.25	24.75	28.50	33.00	35.00
300 "	7.50	14.50	19.75	22.75	28.00	32.25	37.25	39.50

Covers: 50 for $2.00—additional covers 1½c each.

California State 3% Sales Tax to be added if delivered within the state.

B U L L E T I N   O F   T H E

Southern California Academy of Sciences

LOS ANGELES, CALIFORNIA

Vol. XXXVII   May-August, 1938   Part 2

CONTENTS

Issued October 10, 1938

A COYOTE-LIKE WOLF JAW FROM THE RANCHO LA BREA PLEISTOCENE

By Chester Stock

Examination of several hundred lower jaws in the collections of the Los Angeles Museum representing principally the coyote but including also timber wolf material from the Pleistocene of Rancho La Brea brings to light a single specimen of unique character from excavation No. 61. This mandible No. V 5203, consists of the two rami with the dentition including $P_{\overline{2}}$ - $M_{\overline{1}}$ inclusive. $P_{\overline{1}}$ is absent. The jaw, Plate 10, figs. 1 and 2, is characterized by a shortness and massiveness in which it exhibits a decided contrast to the mandible of the coyote from Rancho La Brea. Massiveness is particularly displayed by the horizontal ramus which is noticeably thicker transversely than in the coyote and is more like that in the timber wolf. This is likewise true when the specimen is compared with jaws that belong to larger individuals of the extinct coyote from the asphalt deposits. A distinctive feature of the wolf separating it from the coyote is the greater convexity of the inferior margin of the horizontal ramus. In this character No. V 5203 is more like the former than the latter.

The premolars in No. V 5203 are closely spaced, $P_{\overline{1}}$ is absent, the diastema between $P_{\overline{2}}$ and $P_{\overline{3}}$ is short, and the individual teeth are noticeably wider for their length in specimen No. V 5203 than in the coyote. $M_{\overline{1}}$ is relatively short and wide. In the heel region of this tooth the hypoconid relative to the size of the entoconid is a larger cusp than in the coyote.

Comparison with the timber wolf, based upon jaws from Rancho La Brea and several recent specimens available from western North America, clearly emphasizes the small size of No. V 5203. In this character the specimen is more like a coyote. The dentition while suggestive of the heavier dentition occurring in the timber wolf comprises teeth that are distinctly smaller than the teeth of wolves and are more like those in the coyote.

Among the several types of canids described from the Rancho La Brea Pleistocene the nearest approach to No. V 5203 in the characters mentioned above is made by *Canis andersoni*. This animal recognized by J. C. Merriam[1] on the basis of a single specimen was regarded as a short-headed, coyote-like wolf distinct from any other known type of canid from Rancho La Brea. Unfortunately this skull lacks the mandible. Comparison of the Los Angeles Museum specimen with the skull of

[1] Merriam, J. C., Mem. Univ. Calif., vol. 1, no. 2, pp. 260-261, figs. 41, 42, 1912.

C. andersoni in the University of California collection discloses the fact that the former is larger. It is likewise apparent that the mandible of *C. andersoni* would have been more slender than No. V 5203. As Merriam points out, the type of *C. andersoni* belongs to a young individual. However, it seems unlikely that the differences between No. V 5203 and No. 12249 U. C. C., the type of *C. andersoni,* are due entirely to age. Merriam has indicated that the upper carnassials, the only teeth preserved with the skull are approximately the size of those in the living coyote, but appear to be slightly thicker. As described above the lower teeth in No. V 5203 are likewise slightly thicker than in the coyote. On the basis of the ratio, length of $P^{\underline{4}}$: length of $M^{\overline{1}}$, in the modern coyote, the length of $M^{\overline{1}}$ in No. V 5203 is close to the estimated length of this tooth as determined from the length of $P^{\underline{4}}$ in *C. andersoni.* Thus the differences between No. V 5203 and the type of *C. andersoni* are exhibited principally in the mandible. These are regarded of sufficient weight to establish the following species:

Canis petrolei, n. sp.

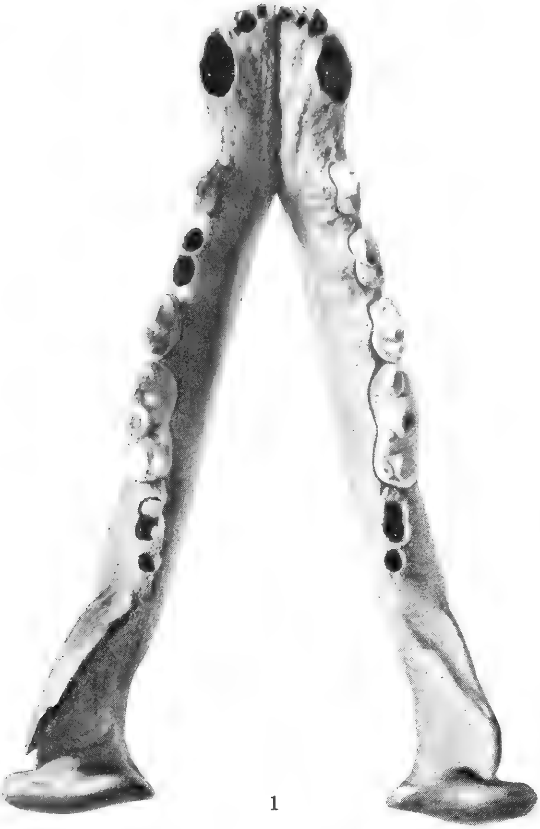
Type specimen: No. V-5203 L. A. Mus. Coll., a mandible with $P^{\overline{2}}$ - $M^{\overline{1}}$, Plate 10.

Locality: L. A. Mus. Excavation No. 61, Rancho La Brea Pleistocene.

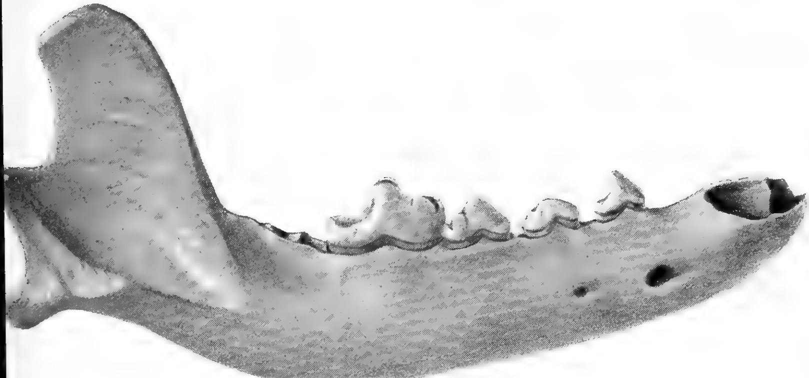
Specific characters: Mandible heavier and shorter than in Recent coyotes of California or in *Canis latrans orcutti* from the Rancho La Brea Pleistocene. Convexity of lower border of mandible more like that in the timber wolf than like that in the coyote. Differs from short-headed Pleistocene coyote, *Canis andersoni,* in larger size and heavier build.

Measurements (in millimeters)

Length from anterior end of C to posterior end of $M^{\overline{3}}$, alveolar measurement	94.1
Length $M^{\overline{1}}$ - $M^{\overline{3}}$	36.8
$P^{\overline{2}}$ — length 10; width	4.7
$P^{\overline{3}}$ — length 11.1; width	5.3
$P^{\overline{4}}$ — length 12.2; width	6.3
$M^{\overline{1}}$— length 22.1; width	9.3
Length from anterior end of symphysis to posterior end of condyle	149.1
Height of coronoid process	58.6
Height of condyle	30
Depth of ramus at anterior end of $M^{\overline{1}}$	25
Thickness of ramus below trigonid portion of $M^{\overline{1}}$	13.2



1



2

PLATE 10

Figures 1 and 2. *Canis petrolei*, n. sp. Mandible, No. V 5203, L. A. Mus. Coll.; superior and lateral views, x ¾. Rancho La Brea Pleistocene. Photograph by E. S. Cobb.

TWO NEW LAND SHELLS FROM KERN COUNTY, CALIFORNIA

By G. Willett

A few months ago Kenneth E. Stager, ornithologist, brought in a shell of a snail that he had found in the Piute Mountains, Kern County, California. Although the specimen was much bleached, it proved so interesting that it appeared well worth while to investigate the locality further. Consequently, on May 29, 1938, the writer and his wife accompanied Mr. Stager to the locality where the shell had been found, and a careful search of several hours by the three of us resulted in securing sixteen specimens, only one of which was living, however. These were all found under rocks in slides on a steep mountain slope, on the southwest side of Erskine Creek, about 1,000 feet above the creek bottom, at an altitude of approximately 5,500 feet.

A study of the above specimens appears to indicate that this snail is an undescribed species of *Helminthoglypta,* which may be known as

Helminthoglypta stageri sp. nov. (Pl. 11)

Description: Shell large for the genus, depressed, conspicuously umbilicate, about one-third of the umbilicus covered by the reflection of the inner lip. Color light brown, paler on the base, with a dark chestnut-brown band, from one to two millimeters in width, encircling the last whorl at the shoulder; above and below the brown band are rather indefinitely defined light bands, the lower one being about as wide as the dark band and the upper one somewhat narrower. Aperture oval, very oblique. Spire depressed; whorls convex, the last whorl descending in

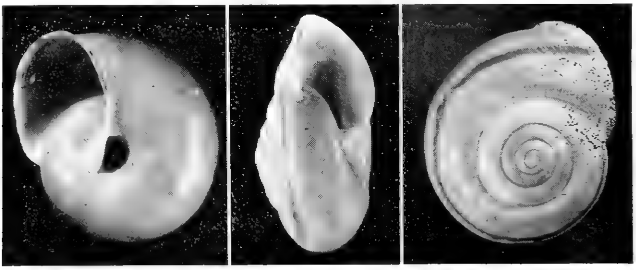


PLATE 11

Helminthoglypta stageri, Willett.
Photograph of type, natural size.

front. Nuclear whorls finely but thickly papillated, radiately wrinkled; papillae becoming larger and more widely spaced on later whorls, and hardly apparent on the last whorl excepting immediately behind the aperture and in the umbilicus. Last whorl with no apparent spiral sculpture.

Type No. 1055, Los Angeles Museum, collected by G. Willett at about 5,500 feet altitude on the southwest side of Erskine Creek, Piute Mountains, Kern County, California, May 29, 1938. Paratypes in California Academy of Sciences, Academy of Natural Sciences of Philadelphia, and the collection of the writer. The type has six whorls and measures in millimeters: Greater diameter, 31.5; lesser diameter, 24.8; height from umbilicus to apex, 12.3.

Remarks: This species, when inspected without magnification, is surprisingly similar to typical *H. petricola* Berry, from Mill Creek, San Bernardino Mountains. However, considering the distance between the known ranges of the two shells, that several mountain ranges and valleys lie between, and that numerous other species of *Helminthoglypta* occupy the intervening territory, the genetic relationship of the two can hardly be very close. *Stageri* is of slightly more depressed form than *petricola* and appears to lack entirely the incised spiral lines nearly always present in that species.

Incidentally, Californian students of this group of mollusks are unable to understand Dr. Paul Bartsch's contention (Proc. U. S. Nat. Mus., 51, 1916, pp. 612-613) that *H. petricola* is assignable to typical *H. traski* (Newc.). Although there has been some doubt expressed as to whether the two are more than subspecifically distinct, it is generally conceded that they are very different.

On July 2, 1938, the writer and his wife returned to the Piute Mountains, on this occasion going to the top of the main ridge. Camp was established among pine and fir timber along the Piute Mountain road ten and one-half miles southeast of its intersection with the Walker Basin-Bodfish road. At this point there is a small spring from which water is piped to a metal trough just below the road. On the afternoon of July 2 and the following day, by searching under and along fir logs, we succeeded in obtaining twenty living snails, nearly all immature. These were usually attached to the under side of pieces of bark. An examination of these specimens reveals that they represent an undescribed form, which may be called

HELMINTHOGLYPTA CUYAMACENSIS PIUTENSIS subsp. nov. (Pl. 12)

Description: Shell openly umbilicated, inner lip only slightly reflected over umbilicus. Apex much depressed. Aperture round-oval, oblique; outer lip descending somewhat at the suture. Color

about mummy brown, of Ridgway, lighter on the base; at the shoulder is a darker brown band slightly more than one millimeter in width, bordered above and below by narrower, obscurely defined, lighter bands. Entire upper surface finely papillated, the papillae becoming finer and less distinct on the lower part of the last whorl, where they are most pronounced inside and behind the aperture, and in the umbilicus. No spiral sculpture apparent.

Type No. 1056, Los Angeles Museum, collected by G. Willett on Piute Mountains, Kern County, California, altitude about 7,000 feet, July 3, 1938. Paratypes in California Academy of Sciences, Academy of Natural Sciences of Philadelphia, and collection of the writer. The type has five and one-eighth whorls and measures in millimeters: Greater diameter, 24; lesser diameter, 19.8; height from umbilicus to apex, 8.2.

Remarks: This shell is much flatter above than any other known race of the species. It appears to be larger and less evenly papillated than *H. c. cuyamacensis* and *H. c. venturensis*, and has a much more open umbilicus than *H. c. avus*.

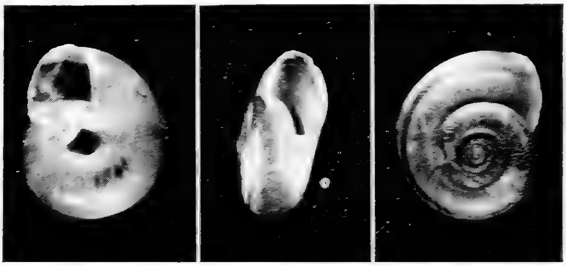


PLATE 12

Helminthoglypta cuyamacensis piutensis Willett.
Photograph of type, natural size.

A STUDY OF SOME NORTH AMERICAN MOTHS ALLIED TO THE THYATIRID GENUS BOMBYCIA HÜBNER

By J. F. Gates Clarke and Foster H. Benjamin[1]

Of the Bureau of Entomology and Plant Quarantine,
United States Department of Agriculture

The present paper was begun by Foster H. Benjamin, but his uncompleted manuscript, which was being written to precede Dr. W. T. M. Forbes' paper on the Thyatiridae (1936),[2] was only recently discovered.

In his manuscript Benjamin had described as new the genus *Bycombia* and the species *Bombycia semifasciata* and *Bombycia crumbi* (herein placed in the new genus *Ceranemota*). The new genus *Bycombia* and the two new species mentioned above must be credited to him. In addition I have described one new genus and three new species.

Forbes discussed the genera of this family and clearly showed the differences between them. He preferred, however, to consider *Bombycia* in the broad sense and included in it the North American species herein referred to *Ceranemota*. *Bombycia*, however, should be restricted to *or* D. and S., and its congeners. In this same paper Forbes also mentioned *B. verdugoensis* Hill, stating that it belonged in the *Bombycia* complex but that he had not studied it critically. His statement was, I believe, made with full knowledge of the facts but in anticipation of the publication of Benjamin's proposed paper and in courtesy to him.

The present paper is based on a study of specimens in the collection of the United States National Museum.

The drawings were made under my supervision by Mrs. Eleanor A. Carlin of the Bureau of Entomology and Plant Quarantine.

J. F. G. C.

The following keys will serve to separate *Bombycia, Bycombia* and *Ceranemota.*

---

[1] Deceased.

[2] Forbes, W. T. M., Ann. Ent. Soc. Amer., vol. 29, pp. 779-803, 1936.

Key Based on External Characters

1.	Frontal tuft of head present	2
	Frontal tuft of head absent	*Bombycia*
2.	Fore wing with accessory cell	*Ceranemota*
	Fore wing without accessory cell	*Bycombia*

Keys Based on Genitalic Characters

Males

1.	Uncus simple	*Bombycia*
	Uncus divided	2
2.	Clasper present	*Ceranemota*
	Clasper absent	*Bycombia*

Females

1.	Ductus bursae membranous	2
	Ductus bursae strongly sclerotized, at least for part of its length	*Ceranemota*
2.	Ductus seminalis with sclerotized band at base	*Bycombia*
	Ductus seminalis without sclerotized band at base	*Bombycia*

Ceranemota Clarke, new genus

Genotype: *Bombycia improvisa* (Hy. Edwards).

Antenna with basal scale tuft; segments of male antenna strongly ciliate, each with a carinate process beneath, the processes smaller on the basal and terminal segments in proportion to the tapering of the antenna. Antenna of female similar but pubescent rather than ciliate and the processes of the segments smaller. Proboscis present, with saw-like tip. Palpus moderately long; first and second segments clothed with much long hair beneath; third segment porrect, about two-thirds the length of second, clothed with scales. Gena narrow, lunate. Frons tufted with hair-like scales; occiput strongly tufted with hair and thin bifurcate scales; eye rather large, round, naked, strongly lashed.

Thorax clothed with hair and furcate scales; collar divided, the furcations joining the tegulae to form two erect crests; metathorax hairy but not strongly tufted. Abdomen untufted and clothed mainly with scales; first to third segments slightly hairy above.

Fore wing moderately broad, termen evenly curved; 12 veins; vein 3 from near angle of cell, approximate to 4 at base; 5 weak, from middle of discocellulars; 6 connate with the stalk of 7 and 8; stalk of 7 and 8 fusing with 9, beyond the stalk of 9 and 10, to form accessory cell; 10 reaching costa; 11 from well beyond middle of cell.

Hind wing with apex rounded; veins 3 and 4 closely approximate; 5 weak, from slightly below middle of discocellulars; 6 straight from upper angle of cell; 7 from well before angle, 7 and 8 closely approximate to slightly beyond origin of 7.

Male genitalia: Symmetrical. Harpe strongly sclerotized in basal half, less strongly so in distal half; clasper formed by an extension of the sacculus. Uncus bifurcate, naked. Socii small, digitate. Aedeagus with terminal hook; vesica armed with patch of small cornuti. Vinculum broadly excavate.

Female genitalia: With ostium as broad as width of segment. Ductus seminalis from ventral surface of ductus bursae. Signum present, small, scobinate.

Ceranemota is closely allied to *Bycombia* and also to *Bombycia* and *Nemacerota.* It may be distinguished from *Bombycia* (*B. or* D. & S., and its congeners) by the bifurcate uncus, well developed clasper, and reduced socii in the male and the strongly sclerotized ductus bursae in the female. *Nemacerota* lacks the uncus entirely and possesses greatly exaggerated socii. The characters by which *Bycombia* may be separated from *Ceranemota* will be found in the descriptions of the two genera.

Key to the Species of Ceranemota

Males

1. Aedeagus with a prominent, rounded ventral projection (Figures 3a, 7a-9a) 2
   Aedeagus without such ventral projection (Figures 2a, 4a-6a) 5
2. Tegumen with dorsal prominence (Figure 8b) .... *partida*
   Tegumen without dorsal prominence (Figure 9b) 3
3. Clasper short, narrowly pyramidal (Figure 7) .... *albertae*
   Clasper not pyramidal (Figures 3, 9) 4
4. Clasper extending far beyond margin of harpe; ventral margin of harpe evenly rounded (Figure 9) .... *tearlei*
   Clasper extending short distance beyond edge of harpe; ventral margin of harpe angulate (Figure 3) *semifasciata*
5. Tegumen without dorsal prominence 6
   Tegumen with dorsal prominence (Figure 2b) .... *amplifascia*
6. Clasper large, attaining middle of harpe (Figure 6) .... *fasciata*
   Clasper much smaller, never attaining middle of harpe (Figures 4, 5) 7
7. Distal end of clasper pointed (Figure 4) .... *crumbi*
   Distal end of clasper truncate (Figure 5) .... *improvisa*

Females[3]

1. Ductus seminalis strongly sclerotized basally (Figures 10, 13, 15, 16) 2
   Ductus seminalis membranous or only slightly sclerotized as base (Figure 14) .... *fasciata*

2. Anterior margin of ostium concave (Figures 10, 12, 13, 16) 3
   Anterior margin of ostium V-shaped (Figures 11, 15) 6

3. Tergite of 8th segment nearly as broad as width of ductus bursae (Figures 12, 13) 4
   Tergite of 8th segment narrow (Figures 10, 16) 5

4. Posterior edge of 8th tergite deeply concave; signum well developed (Figure 12) .... *partida*
   Posterior edge of 8th tergite slightly concave; signum poorly developed (Figure 13) .... *albertae*

5. Anterior apophyses shorter than width of ductus bursae at middle (Figure 16) .... *crumbi*
   Anterior apophyses longer than width of ductus bursae at middle (Figure 10) .... *improvisa*

6. Eighth tergite broad (Figure 11) .... *tearlei*
   Eighth tergite narrow (Figure 15) .... *amplifascia*

Ceranemota improvisa (Hy. Edwards), new combination

Plate 14, Figs. 5, 5a; Plate 16, Fig. 10; Plate 17, Figs. 17, 20

Cymatophora improvisa Hy. Edwards, Proc. Calif. Acad. Sci., vol. 5, p. 189, 1873.—Barnes and McDunnough, Check List of the Lepidoptera of Boreal America, No. 3696, 1917.—Blackmore, Check List of the Macrolepidoptera of British Columbia, p. 33, 1927.

Cymatophora or race *improvisa* (Hy. Edwards) Turner, Ent. Rec. (suppl.), vol. 38, p. 19, 1926.

Bombycia improvisa (Hy. Edwards) Grote, Can. Ent., vol. 6, p. 154, 1874; Bul. Buff. Soc. Nat. Sci., vol. 3, p. 78, 1875.—Stett. Ent. Zeit., vol. 37, p. 134, 1876; Papilio, vol. 1, p. 76, 1881.—Smith, List of the Lepidoptera of Boreal America, No. 1464, 1891; U. S. Nat. Mus. Bul. 44, p. 29, 1893.—Grote, Abhandl. Natur. Ver. Bremen, vol. 14, p. 10, 1895.—Dyar, List of North American Lepidoptera, No. 3184, 1903.—Smith, Check List of the Lepidoptera of Boreal America, No. 3332, 1903.—Anderson, Catalogue of British Columbia Lepidoptera, No. 698, 1904. — Barnes and McDunnough,

[3] I have not seen the female of *semifasciata*.

Journ. N. Y. Ent. Soc., vol. 18, p. 160, 1910.—Day, Proc. B. C. Ent. Soc., No. 1 (n.s.), p. 30-33, 1911.—Barnes and McDunnough, Cont. Lepid. N. Amer., vol. 4, pl. 12, fig. 4, 1912.

Male genitalia: Cucullus broad, rounded; clasper short, pyramidal, truncated. Anellus a broad rectangular plate, scobinate in posterior half and with a broad, deep median excavation; lateral lobes well developed. Aedeagus stout, without rounded ventral prominence; terminal hook long, sharply curved. Socii large, pointed. Uncus stout, prongs broad, narrowly separated.

Female genitalia: Tergite of 8th segment narrow with slightly concave posterior margin. Anterior margin of ostium concave. Posterior half of ductus bursae strongly sclerotized, especially so just before ostial opening. Basal portion of ductus seminalis two-thirds the width of the ductus bursae, strongly sclerotized. Signum a small, scobinate, elongate plate.

Alar expanse, 34-37 mm.

Type: In American Museum of Natural History.

Type locality: Cascades, Washington.

Food plant: Wild Cherry.

Distribution: United States—California: Male (no date or collector). Washington: Bellingham, male (1923, J. F. G. Clarke); Pullman, female (July, C. V. Piper); Seattle, male (O. B. Johnson). Canada—British Columbia: Duncan, 11 males, 7 females (October dates, A. W. Hanham); Victoria, 5 males, female (October dates).

Remarks: The female genitalia of *improvisa* are more nearly symmetrical than those of *crumbi* and have a narrower 8th tergite. The signum is more elongate and the anterior apophyses are nearly twice as long in *improvisa* as in *crumbi*. This and *crumbi* are very closely related. In the male genitalia of *improvisa* the vinculum is very broad with a deep excavation, in *crumbi* the vinculum is narrow with a broad shallow excavation. The socii are longer and more pointed and the aedeagus is shorter and stouter in *improvisa* than in *crumbi*.

Ceranemota fasciata (Barnes and McDunnough) (new combination)

Plate 14, Figs. 6, 6a; Plate 16, Fig. 14

Bombycia fasciata Barnes and McDunnough, Journ. N. Y. Ent. Soc., vol. 18, p. 160, 1910.—Day, Proc. B. C. Ent. Soc., No. 1 (n.s.), p. 30, 1911. — Barnes and McDunnough, Cont. Lepid. N. Amer., vol. 1, pl. 12, fig. 5, 1912.

Cymatophora fasciata Barnes and McDunnough, Check List of the Lepidoptera of Boreal America, No. 3698, 1917.

Cymatophora or race *fasciata* (Barnes and McDunnough) Turner, Ent. Rec. and Jour. Variation (suppl.), vol. 38, p. 19, 1926.

Male genitalia: Harpe broad, of about equal width throughout; cucullus broadly rounded; clasper large, pyramidal, pointed. Anellus a large rectangular plate scobinate on posterior half; lateral edge with concavity in posterior half; median incision deep, broad. Aedeagus without ventral rounded prominence; terminal hook long, pointed. Socii large, pointed. Prongs of uncus short, flat, separated by a small median excavation.

Female genitalia: Tergite of collar moderately broad and of nearly equal width throughout. Anterior edge of ostium evenly concave. Posterior third of ductus bursae strongly sclerotized. Basal portion of ductus seminalis only lightly sclerotized. Signum small but well developed.

Alar expanse, 37-42 mm.

Type: In United States National Museum, No. 52691.

Type locality: Duncan, Vancouver Island, British Columbia.

Food plant: *Prunus occidentalis* Swartz.

Distribution: United States—Washington: Mt. Rainier, male ("22-VII-1923", Geo. P. Engelhardt). Canada—British Columbia: Duncan, Vancouver Island, 10 males, 33 females (September and October dates, A. W. Hanham); Westminster, female (no date or collector).

Remarks: This species may be distinguished from all others described from North America by the unusually large pyramidal clasper in the male and the relatively small sclerotized portion of the ductus bursae of the female.

Ceranemota crumbi Benjamin, new species

Plate 14, Figs. 4, 4a; Plate 16, Fig. 16

A dark brown species near *improvisa* Hy. Edw. but lacking all of the pale gray and practically all of the green coloration of that species.

Labial palpus fuscous with white scales intermixed; apex of third segment white; front black, scales white-tipped; apical tuft of head dull rufous brown, the latter irrorated and suffused with black; tegula edged with black anteriorly and along inner margin; at middle of base of wing a prominent fuscous scale tuft followed by a few greenish-tinged white scales; costa narrowly, but distinctly, pink; transverse median fascia ill defined and indicated chiefly by the indistinct broad rufous transverse anterior and posterior lines; cilia fuscous with a narrow, crenulate, black basal line. Hindwing smoky fuscous, lighter basally; ciliar light

fuscous, lightly suffused with pink, with a distinct, narrow, fuscous basal line; fore and hind wings with golden sheen. Fore and mid legs fuscous annulated and irrorated with whitish ochreous; hind leg whitish ochreous irrorated with fuscous; all legs suffused with pink.

Male genitalia: Harpe evenly and gently tapered to the rounded cucullus; clasper short, stout, pointed, pyramidal. Anellus elongate, rectangular, finely scobinate in posterior two-thirds, deeply and narrowly incised from posterior edge; lateral, fleshy, hairy lobes prominent. Aedeagus without lateral rounded prominence; terminal hook rather long, slender. Socii short, roundly pointed. Uncus stout; prongs broad, short, with a shallow excavation between.

Female genitalia: Dorsal tergite of collar moderately broad, of even width throughout. Anterior margin of ostium deeply concave. Inception of ductus seminalis short, broad, strongly sclerotized. Signum a small, but well defined, round, scobinate plate.

Alar expanse, 35-37 mm.

Type: United States National Museum No. 52268.

Type locality: Paradise Valley, Mt. Rainier, Washington.

Food plant: *Pyrus occidentalis* S. Wats.

Remarks: Described from the male type and three male and three female paratypes from the type locality as follows: Female and three males ("9-24-30"); male ("9-19-30"); female (Aug. 7, 1930) all reared from larvae collected by S. E. Crumb.

Ceranemota semifasciata Benjamin, new species

Plate 13, Figs. 3, 3a

Rufous colorations and fasciate pale transverse posterior and subterminal lines similar to those of *fasciata* B. & McD., but with the ground ashy gray as in *tearlei* Hy. Edw.

Antenna rufous with white scales sprinkled throughout; basal segment white. Labial palpus brownish fuscous irrorated with white; first segment with a distinct triangular white spot outwardly at apex; apex of third segment white. Head rufous with white laterally.

Thorax rufous; tegula gray; inner edge narrowly dark brown. Fore wing gray with a pale greenish dusting along costa; base of fore wing white with a small black spot near center; beyond this small black spot, and obliquely toward inner margin, a small tuft of black and white scales; transverse anterior and posterior lines broad rufous, the former preceded by a broad more or less indistinct fuscous shade, the latter followed by a narrower band of the same color; on costa, beyond the transverse posterior line,

four small fuscous spots, the two outer ones better defined than the two inner ones; at apex a well defined triangular whitish patch which narrows to form a distinct whitish subterminal line; before cilia a narrow, crenulate, black line; cilia light fuscous, white-tipped. Hind wing light yellowish fuscous, lighter basally; cilia fuscous at apex fading to whitish basally; subbasal line narrow, fuscous.

Fore and middle legs fuscous with creamy white annulations. Hind leg creamy white.

Male genitalia: Clasper of harpe short, pointed; margin of sacculus angulate; cucullus narrow, rounded. Anellus a rectangular plate, moderately sclerotized except for narrow central membranous portion; finely scobinate in posterior half; lateral edge near posterior end deeply concave. Aedeagus with large rounded ventral prominence; terminal hook short, stout. Socii somewhat compressed, bluntly pointed. Prongs of the uncus widely separated, much narrower than the excavation separating them. Tegumen without dorsal prominence.

Alar expanse, 35 mm.

Type: United States National Museum No. 52270.

Type locality: Siskiyou County, California (Koebele).

Remarks: Described from the unique male type. The genitalia of *semifasciata* are similar to those of *tearlei* Hy. Edw., but have a less strongly bifurcate uncus and smaller extension of the sacculus.

Ceranemota tearlei (Hy. Edwards) (new combination)

Plate 15, Figs. 9, 9b; Plate 16, Fig. 11

Gluphisia tearlei Hy. Edwards, Ent. Amer., vol. 2, p. 11, 1886.

Bombycia tearlei Hy. Edwards, Ent. Amer., vol. 4, p. 63, 1888.—Grote, Abhand. Natur. Ver. Bremen, vol. 14, p. 10, 1895.

Bombycia tearlii (Hy. Edwards) Smith, List of the Lepidoptera of Boreal America, No. 1466, 1891; U. S. Nat. Mus. Bul. 44, p. 29, 1893; Check List of the Lepidoptera of Boreal America, No. 3333, 1903.—Wolley Dod, Can. Ent., vol. 38, p. 51, 1906.—Barnes and McDunnough, Cont. Lepid. N. Amer., vol. 1, pl. 12, fig. 19, 1912.

Cymatophora tearli Barnes & McDunnough, Check List of the Lepidoptera of Boreal America, No. 3697, 1917.—Blackmore, Check List of the Macrolepidoptera of British Columbia, p. 33, 1927.

Cymatophora or ab. race *tearlii* (Hy. Edwards) Turner, Ent. Rec. and Jour. Variation (suppl.), vol. 38, p. 19, 1926.

Male genitalia: Harpe narrow beyond clasper, cucullus bluntly pointed; clasper extending far beyond ventral margin. Anellus broad, roughly rectangular, postero-lateral edge deeply excavated; a deep V-shaped incision from posterior margin; in middle of anterior half a clear triangular area; almost entire sclerotized part scobinated. Aedeagus with a large, rounded ventral protuberance; terminal hook bluntly pointed. Socii small, pointed. Prongs of uncus long, relatively narrow, with a moderately broad, deep U-shaped excavation between. Tegumen without dorsal process.

Female genitalia: Ostium broadly V-shaped. Tergite of collar broad with postero-median concavity. Ductus bursae strongly sclerotized throughout most of its length; posteriorly narrowed before ostium; broadened and flattened anteriorly. Basal, sclerotized portion of ductus seminalis long, narrow. Signum weak, small.

Alar expanse, 35-40 mm.

Type: In American Museum of Natural History.

Type locality: Lake Tahoe, California.

Distribution: United States—California: Placer Co., 11 males, 8 females (September and October dates; Koebele and C. V. Riley); Santa Rosa, male (no date or collector); Sierra Nevada, male (no date or collector). Utah: Deer Creek, Provo Cañon, 4 males, 6 females ("8-11-IX-1918"; "1-X-1912", Tom Spalding); Eureka, male ("14-IX-1910", Tom Spalding). Canada—British Columbia: Marron Lake and Kaslo (acc. Blackmore).

Remarks: This species undoubtedly will be found in other western States, particularly in eastern Oregon and Washington.

Dyar[4] and Holland[5] both place this species as a synonym of *improvisa* Hy. Edwards.

I wish to thank Dr. A. B. Klots of the College of the City of New York for comparing slides of the genitalia of specimens in the National collection with those of the type.

Ceranemota partida, new species

Plate 15, Figs. 8, 8b; Plate 16, Fig. 12

This species is inseparable from *tearlei* in external characters but may be distinguished by characters of the genitalia.

Male genitalia: Harpe short; cucullus broadly rounded; clasper greatly exceeding ventral margin of harpe, pointed, with a short, triangular lateral projection near distal end. Anellus rectangular, moderately sclerotized; postero-lateral corners al-

[4] Dyar, H. G., a List of North American Lepidoptera, No. 3184, 1903.

[5] Holland, W. J., The Moth Book, p. 304. pl. 40, fig. 27, 1903.

most wholly membranous. Aedeagus stout, with well developed, rounded, ventral process; terminal hook broad, somewhat flattened. Socii small pointed. Uncus short, broad; prongs broad with a narrow horseshoe-shaped excavation between. Tegumen with dorsal prominence.

Female genitalia: Tergite of 8th segment broad; posterior edge deeply concave. Anterior margin of ostium concave. Ductus bursae broad, strongly sclerotized almost to bursa couplatrix. Inception of ductus seminalis narrow, strongly sclerotized, situated about half way between bursa copulatrix and ostium. Signum a small but well developed, sclerotized, scobinate plate.

Alar expanse, 36-41 mm.

Type: United States National Museum No. 52271.

Type locality: Glenwood Springs, Colorado (October 8-15).

Remarks: Described from the male type and one male and two female paratypes all from the same locality. The paratypes are as follows: Male (July 8-15); two females (September 16-23; September 24-30).

This species may be distinguished from *tearlei* by the broader vinculum, smaller lobes at the base of the harpe, more slender and more bluntly pointed clasper, shorter uncus and by the presence of a dorsal process of the tegumen. In the female of *partida* the posterior edge of the tergite of the 8th segment is more deeply concave, ductus bursae is broader and the signum is larger than in *tearlei*. In addition the inception of the ductus seminalis of *partida* is much farther forward than in *tearlei*.

Ceranemota albertae, new species

Plate 15, Figs. 7, 7a; Plate 16, Fig. 13

This species is much like *tearlei* and *partida* but is darker and more silvery. The cilia have a slight roseate tinge.

Male genitalia: Harpe narrow beyond clasper; cucullus rounded; clasper short pyramidal; lobes at base of sacculus small. Anellus roughly rectangular, slightly broader posteriorly than anteriorly, scobinate on posterior half; median posterior excavation deep, V-shaped. Aedeagus slender with large rounded ventral process; terminal hook thick, evenly curved. Socii rather long, pointed. Uncus broad, prongs narrow with a broad excavation between. Tegumen without dorsal prominence.

Female genitalia: Tergite of 8th segment moderately broad with slight concavity on posterior edge. Anterior margin of ostium concave. Ductus bursae broad, sclerotized for most of its length. Inception of ductus seminalis broad; sclerotized basal portion

almost reaching bursa copulatrix. Signum very weakly developed, small.

Alar expanse, 36-39 mm.

Type: United States National Museum No. 52269.

Type locality: Head of Pine Creek, Calgary, Alberta. ("I-IX-'03", F. H. Wooley Dod).

Remarks: Described from the male type and one male and one female paratypes all from the same locality. The paratypes are dated as follows: male (23-VIII-'97); female ("20-VIII-01").

The species of this group are all closely similar but may easily be distinguished by their genitalia. *Ceranemota albertae* may be distinguished from *C. tearlei* by the shorter clasper, the absence of a deep excavation between the clasper and cucullus, and the shorter ventral prominence of the aedeagus. The foregoing characters will serve also to distinguish *albertae* from *partida*. In addition *albertae* may be distinguised from *partida* by the absence of the dorsal prominence of the tegumen. The female genitalia likewise present good characters by which the three species may be distinguished. The 8th tergite of *albertae* is narrower than that of *tearlei* and lacks the deep concavity of *partida*. The small poorly developed signum will immediately distinguish *albertae* from the other two.

Ceranemota amplifascia, new species

Plate 13, Figs. 2, 2b; Plate 16, Fig. 15

Antenna yellowish brown; dorsally and basally clothed with whitish-gray scales. Labial palpus gray; second segment strongly suffused with fuscous exteriorly; whitish inwardly; third segment with a broad incomplete median fuscous annulus; apex white.

Head, thorax, and ground color of fore wing ashy gray, mixed with fuscous and white scales. Collar yellowish brown; tegulae crested and narrowly edged inwardly with black. Fore wing with a broad, light median fascia and an area of the same shade before termen, both formed by the numerous overlying white scales; in cell a small fuscous spot; from apex inwardly to vein 7, then indistinctly to tornus, an irregular narrow dentate fuscous line; termed broadly grayish fuscous; t.a. and t.p. lines irregular, narrow brown, the former edged outwardly and the latter edged inwardly with black; at base of wing a small black spot and a small black and white scale tuft. Cilia grayish fuscous.

Hind wing light smoky; cilia concolorous with dark narrow basal line.

Fore leg gray; fore tibia with two blackish annulations; fore tarsus black annulated. Middle and hind legs whitish with a few light fuscous scales intermixed.

Abdomen gray with a faint yellowish cast above.

Male genitalia: Harpe clothed with fine hairs; cucullus narrowly rounded; clasper short, pyramidal, not extending beyond margin of the sacculus. Anellus a rectangular plate, scobinate on posterior half and deeply cleft to about middle; lateral hairy lobes well developed. Aedeagus without prominent lateral projection; terminal hook long, rather slender. Socii short, stout, blunt-pointed. Prongs of the uncus very broad; excavation between them narrow. Tegumen with dorsal process.

Female genitalia: Edge of ostium broadly V-shaped. Dorsal tergite of collar narrow. Ductus bursae sclerotized for two-thirds its length; strongly so in posterior third. Inception of ductus seminalis a strongly sclerotized ventral protuberance of the ductus bursae giving rise to the membranous portion of the duct. Signum a small, moderately sclerotized, scobinate plate.

Alar expanse, 37-41 mm.

Type: United States National Museum No. 52106.

Type locality: Placer County, California (October; Koebele).

Remarks: Described from male type and 2 male and 31 female paratypes all from California as follows: Male, Placer County (September; C. V. Riley); 1 male labeled only "California"; 22 females, Placer County (September and October; Koebele and C. V. Riley); 3 females, Truckee (September; Ximena McGlashan); 2 females, Sierra Nevada (no other data); 1 female, Nevada County (no other data).

This species is similar to *tearlei* Hy. Edw. but may be distinguished from that species by the generally broader transverse fascia of the fore wing, the broader prongs of the uncus, shorter clasper (which does not extend beyond margin of harpe), and the narrower 8th tergite in the female genitalia.

I am indebted to E. P. Van Duzee for a large part of the series from which this species was described.

Bycombia Benjamin, new genus

Genotype: *Bombycia verdugoensis* Hill[6] (Bul. *So. Calif.* Acad. Sci., vol. 26, p. 6, 1927).

Plate 13, Figs. 1, 1a; Plate 17, Figs. 18, 19, 21

Antennal segments of male ciliate, each with a carinate process beneath; the processes smaller on the terminal and basal segments in proportion to the tapering of the antenna. Antenna

[6] Forbes, W. T. M., Ann. Ent. Soc. Amer., vol. 29, p. 784, 1936, incorrectly credits this species to Benjamin.

of female similar but with the processes only about half as long as those of the male. Proboscis present but very short, without sawlike tip. Palpus short, somewhat depressed, the second segment with much long hair and hairlike scales beneath; third segment porrect, nearly as long as second, clothed with long hair and hairlike scales. Gena broad, triangular. Frons tufted with long hair and hairlike scales, the vertex somewhat depressed; occiput with a strong tuft of these bifurcate scales, hairlike scales, and hair; eye small, somewhat narrow but not reniform; very heavily lashed, hairy, the hair very sparse, not long, confused and partly hidden by the lashes yet visible at 75 diameters' magnification.

Thorax clothed mainly with deeply furcate scales, appearing almost hairy; collar somewhat bifurcate, the furcations joining the tegulae to form two prominent ridges; metathorax with a strong furcate tuft. Abdomen untufted and only slightly hairy except for the dorsum of the first segment where the hair simulates a heavy scale tuft.

Fore wing narrow, the costal and hind margins subparallel, outer margin evenly curved; no accessory cell; 12 veins; vein 3 from near angle of cell, approximate to 4 at base; 5 weak, from middle of discocellulars; 6 out of the stalk of 7 and 8; 8 to apex; 9 and 10 stalked, approximate to stalk 6, 7, and 8; 10 not reaching costa.

Hind wing with apex slightly lobate; veins 3 and 4 connate or shortly stalked from lower angle of cell; 5 weak, nearer to 4 than to 6; 6 and 7 approximate; 7 and 8 closely approximate to beyond cell, then divergent.

Male genitalia: Harpe narrow, hairy, without clasper, caudal margin obliquely truncated, cucullus pointed; costa strongly but narrowly sclerotized; sacculus poorly defined, short, narrow, moderately sclerotized; as base of sacculus a fleshy papillum. Anellus a ring, broad and strongly sclerotized ventrally, narrow and membranous dorsally; ventrally, from posterior edge, a deep, narrow median incision. Aedeagus stout, thickest at middle, with a thick, pointed, slightly curved projection near proximal end; vesica armed with a large patch of small cornuti. Vinculum broad, convex. Socii present, near base of uncus, slender, digitate, hairy. Uncus broad witht narrow neck, bifurcate, naked.

Female genitalia: Tergite of 8th segment broad, sclerotized. Ostium broad, deeply concave, anterior edge narrowly sclerotized. Ductus bursae membranous throughout. Ductus seminalis membranous except for a broad sclerotized band at inception. Signum present in the form of a narrow, scobinate, lunate plate.

Remarks: This genus is closely related to the foregoing. It contains only the genotype.

Explanation of Plates

PLATE 13

1-1a. *Bycombia verdugoensis* (Hill). 1, lateral aspect of male genitalia with aedeagus removed; 1a, lateral view of aedeagus.

2-2b. *Ceranemota amplifascia*, new species. 2, ventral aspect of male genitalia with aedeagus removed; 2a, lateral view of aedeagus; 2b, dorsal view of tegumen showing dorsal process.

3-3a. *Ceranemota semifasciata*, new species. 3, ventral aspect of male genitalia with aedeagus removed; 3a, lateral view of aedeagus.

PLATE 14

4-4a. *Ceranemota crumbi*, new species. 4, ventral aspect of male genitalia with aedeagus removed; 4a, lateral view of aedeagus.

5-5a. *Ceranemota improvisa* (Hy. Edwards). 5, ventral aspect of male genitalia with aedeagus removed; 5a, lateral view of aedeagus.

6-6a. *Ceranemota fasciata* (Barnes and McDunnough). 6, ventral aspect of male genitalia with aedeagus removed; 6a, lateral view of aedeagus.

PLATE 15

7-7a. *Ceranemota albertae*, new species. 7, ventral aspect of male genitalia with aedeagus removed; 7a, lateral view of aedeagus.

8-8b. *Ceranemota partida*, new species. 8, ventral aspect of male genitalia with aedeagus removed; 8a, lateral view of aedeagus; 8b, dorsal view of tegumen showing dorsal process.

9-9b. *Ceranemota tearlei* (Hy. Edwards). 9, ventral aspect of male genitalia with aedeagus removed; 9a, lateral view of aedeagus; 9b, dorsal view of tegumen to show absence of dorsal process.

PLATE 16

Female genitalia: ventral view.

10. *Ceranemota improvisa* (Hy. Edwards).
11. *Ceranemota tearlei* (Hy. Edwards).
12. *Ceranemota partida*, new species.
13. *Ceranemota albertae*, new species.
14. *Ceranemota fasciata* (Barnes and McDunnough).
15. *Ceranemota amplifascia*, new species.
16. *Ceranemota crumbi*, new species.

PLATE 17

17. *Ceranemota improvisa* (Hy. Edwards): Wings.
18. *Bycombia verdugoensis* (Hill): Wings.
19. *Bycombia verdugoensis* (Hill): Ventral view of female genitalia.
20. *Ceranemota improvisa* (Hy. Edwards): Lateral aspect of head.
21. *Bycombia verdugoensis* (Hill): Lateral aspect of head.

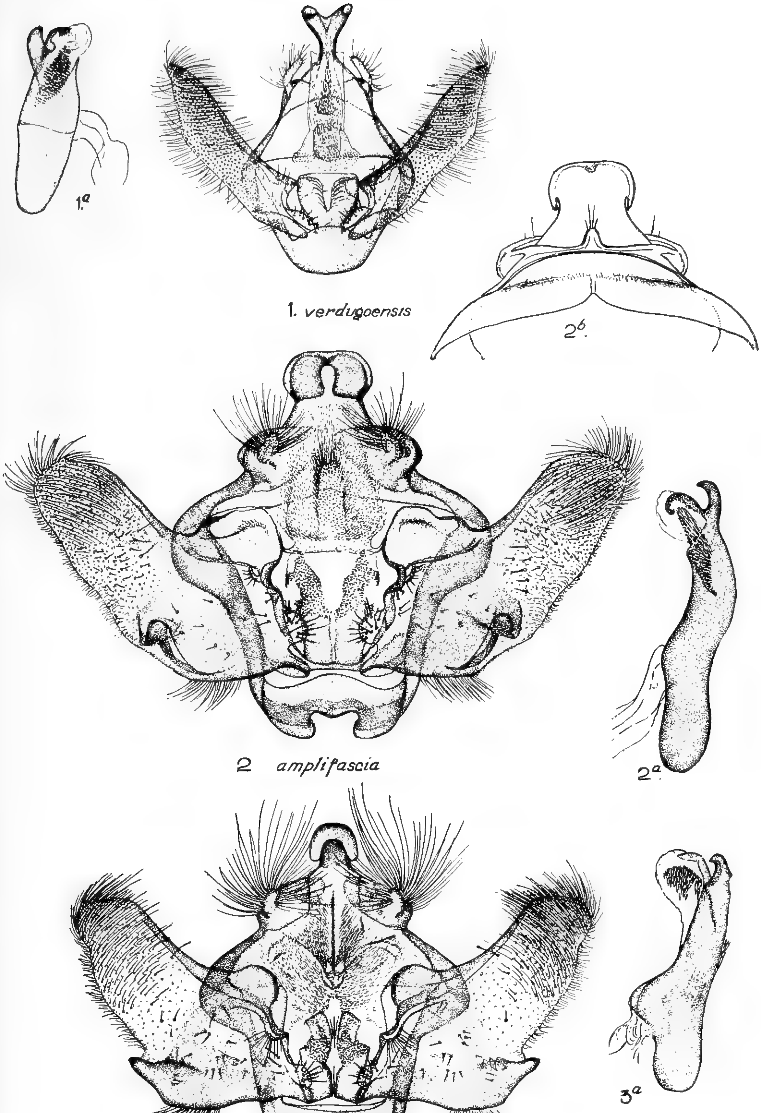
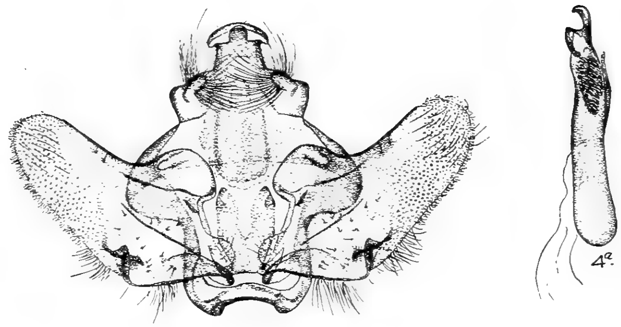
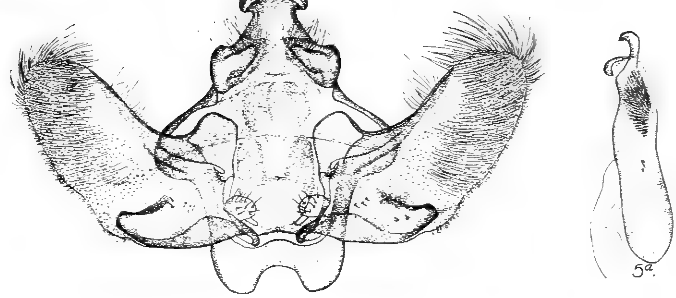


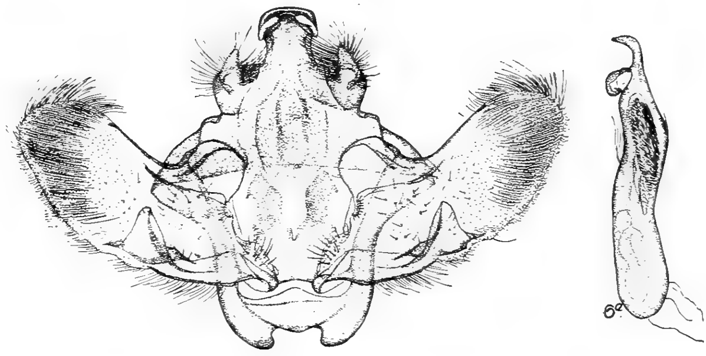
PLATE 13



4. *crumbi*



5. *improvisa*



6. *fasciata*

PLATE 14

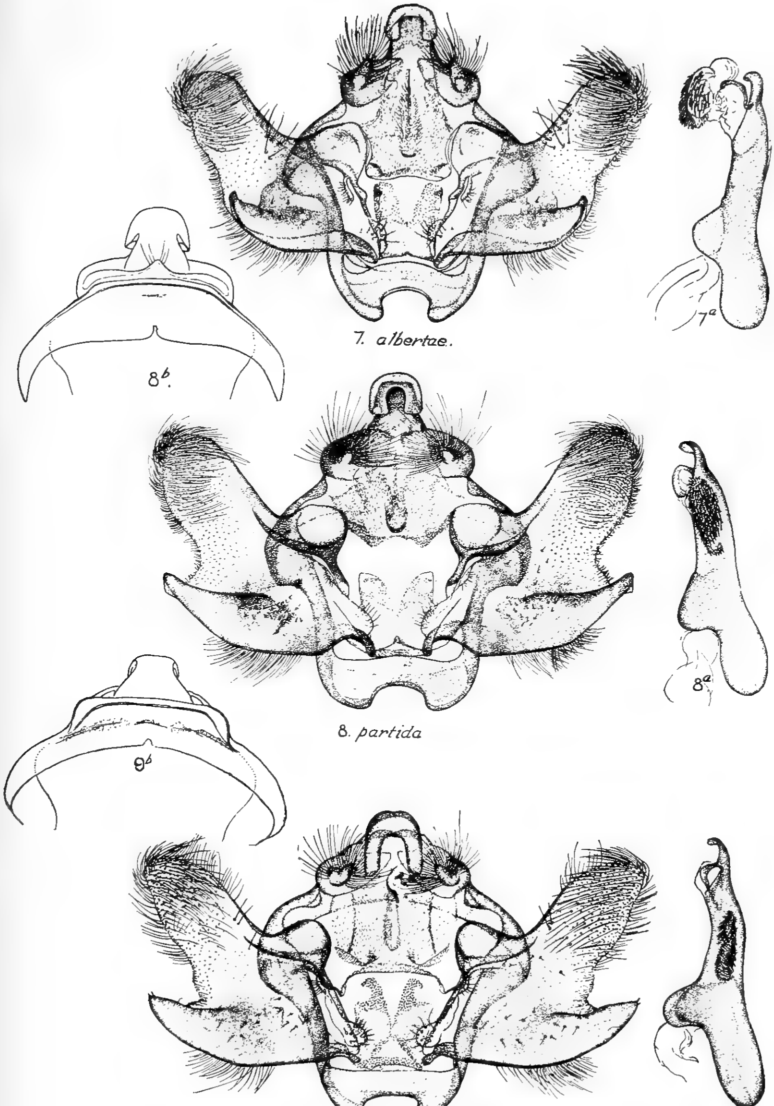


PLATE 15

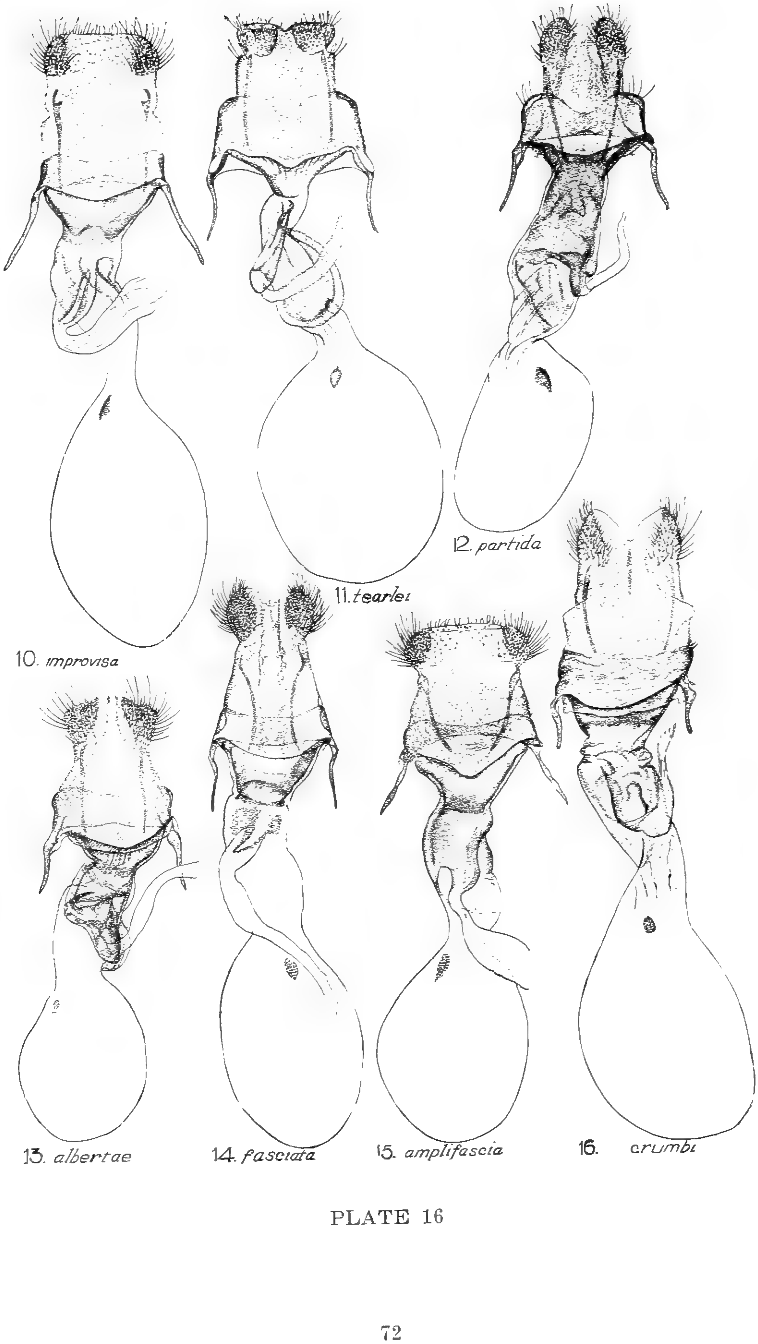
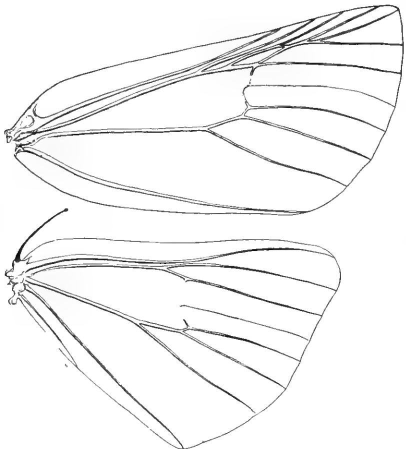
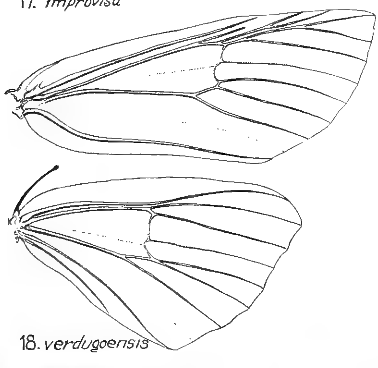

10. improvisa
11. tearlei
12. partida
13. albertae
14. fasciata
15. amplifascia
16. crumbi

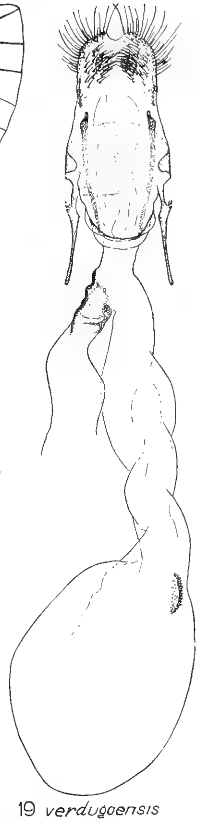
PLATE 16



17. *improvisa*

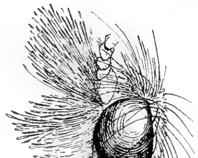


18. *verdugoensis*



19 *verdugoensis*

20. *improvisa*



21. *verdugoensis*

PLATE 17

THE LARVA AND CHRYSALIS OF ANCYLOXYPHA NUMITOR FABR.

By V. G. Dethier
Biological Laboratories, Harvard University

The accurate description of the egg and first two larval instars of this common species by Scudder (1889) constitutes all that is known of its life history with the exception of a few sketchy notes, also by Scudder, on the terminal segments of a chrysalis collected by Harris.

The first instar larva measures from 1.3 to 2 mm. in length; the second instar larva, from 3 to 4 mm.

Third Instar

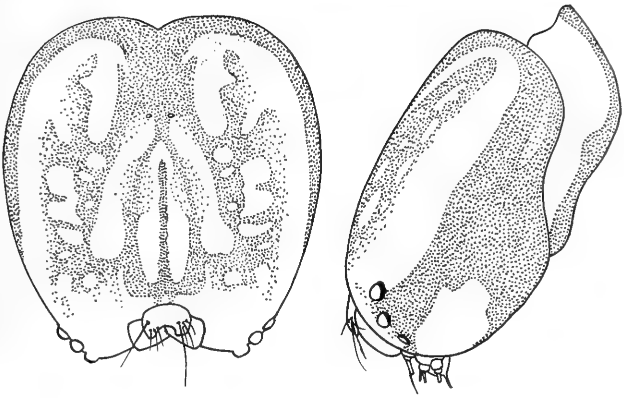
Length, 5 to 7 mm. Head width, .75 mm. Head length, .77 mm. Head shagreened, fuscous, with few scattered short transparent hairs. Ocelli, light fuscous. Mouthparts, dark brown. Dorsal thoracic shield, brown bordered anteriorly by a whitish band. General body color, straw to pale grass green finely mottled with greenish white. Mid-dorsal line not mottled hence appearing darker green than the remainder of the body. Legs and prolegs, pale yellow green. Body covered with many minute dark brown to black setae each arising from a similarly colored papilla. A paradorsal row of small yellowish plate-like setae one to each abdominal segment. Those on the thoracic segments are more subdorsal. The prothorax bears an additional suprastigmatal pair. Each segment not bearing abdominal legs has a subventral pair.

Fourth Instar

Length, 8 to 10 mm. Head width, 1.0 mm. Head length, 1.1 mm. Little change in head and shield. Transparent hairs, shorter. Body similar to previous instar. Setae numerous and short, transparent to fuscous. Hairs from anal plate rather long and transparent. Plate-like setae on this segment conspicuous, yellow with dark brown rims.

Final Instar

Length, 18 mm. Head width, 1.8 to 2 mm. Head length, 2.2 mm. Head shagreened, with very few short hairs. Plate 18 A and B illustrates the distinctive dark brown and white head pattern of this instar. Ocelli, very light brown with a black circumferential ring. Mouthparts, dark brown to black. Dorsal thoracic shield, narrow, dark brown. Anterior edge of prothoracic segment pale yellow green. General body color, light grass



A. B.

PLATE 18

Head of third instar larva of *Ancyloxypha numitor*, enlarged x 20.

A. Front aspect. B. Lateral aspect.

green. Legs and prolegs, very light green to yellow. Body covered with short transparent setae arising from scattered papillae of the same color as the body. Prior to pupation the larva turned dead grass yellow and fell from its nest, coming to lie among the bases of the grass stems.

CHRYSALIS

Length, 15 mm. General color, light cream. Anterior dorsal area, blue gray. Light brown markings as illustrated in Plate 19. The chrysalis differs from that as described by Scudder from Harris' fragment in the following respects:

Scudder's Description	Present Description
reddish ashy color	cream with brown markings
sprinkled with brown dots	no dots
tubercles and bristles black fuscous	setae transparent, papillae green

The descriptions agree in that the sides of the cremaster are deeply channeled and its inferior surface longitudinally combed. The ventral surface of the abdominal segments has exceedingly fine and weak transverse ridges. Harris (1862) described his specimen as being "——long, nearly cylindrical, but tapering at the hinder extremity, and with an obtusely rounded head."

The fragment of this specimen at the New England Museum of Natural History was carefully examined. Scudder's description is accurate, but the poor condition of the fragment renders a color description unreliable. The sprinkling of brown dots appears to be due entirely to the structure of the cuticle intensi-

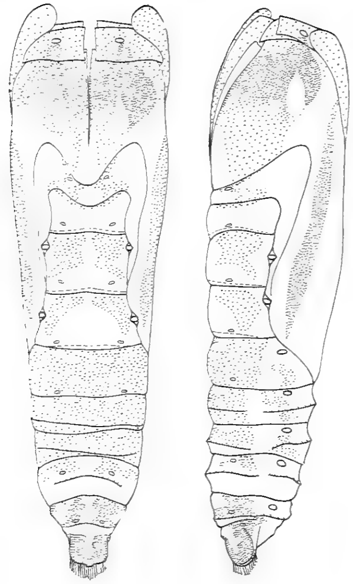


PLATE 19

Chrysalis of *Ancyloxypha numitor*, enlarged approximately x 4.

A. Dorsal aspect. B. Lateral aspect.

fied by drying. Moreover, the dots occur only on a portion of the intersegmental membrane between the last two abdominal segments.

The final instar larva described above was collected from tall lush grass bordering a small brook which ran through an open field. It was procured May 21 by sweeping during the day. It fed by night on various types of grasses and rested by day in a case constructed from two blades of grass held together by silk threads. Pupation occurred May 31. A female emerged June 9.

According to Scudder the first brood of this speciese appears on the wing about the 10th or 12th of June in the vicinity of Boston. As this specimen emerged June 9, it is logical to suppose that it represented the first brood. Scudder also states that the eggs of the third and last brood hatch before the advent of winter. This being the case there can be no doubt that this species passes the winter in the larval state and not as a chrysalis as Scudder was inclined to believe. Hitherto the length of time passed in the pupal stage was unknown. Now it appears that the third brood spends nine days as chrysalids.

Immediately upon emergence the egg-filled female of brood one is ready to be fertilized. This particular specimen oviposited

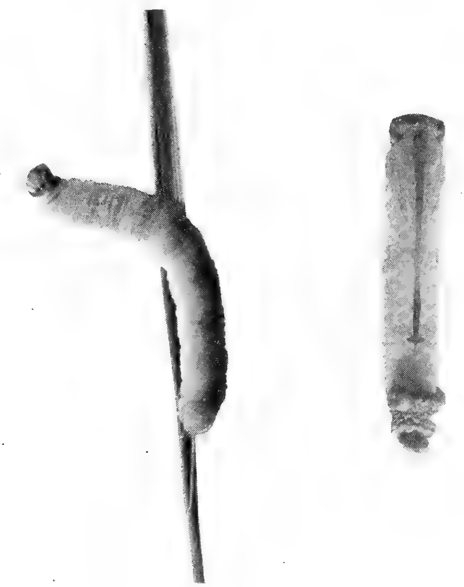
June 14. The eggs of the first brood develop in from four to seven days, hatchings having occurred from June 18 to 21. The first instar is of four to six days' duration, moults occurring June 24; the second instar, four to seventeen days with moults June 28 and July 11; the third instar, nine to twenty-two days, moults occurring July 15 and 20. The last instar of this brood requires about twenty days.

When about to moult the larva retires to its nest where it becomes murky yellow and remains quiescent for two days. The prothorax becomes greatly distended. The skin ruptures along the anterior edge of the shield; the head capsule and integument loosen and are usually discarded simultaneously although frequently the former remains attached for several hours. Actual moulting requires but 60 seconds. The body is pale yellow; the head, dead white; the shield, brilliant white. After forty-five minutes all color has appeared. Usually the cast-off skin is eaten.

Literature Cited

Harris, T. W., 1862. A treatise on some of the insects injurious to vegetation. 3d ed., p. 308.

Scudder, S. H., 1889. Butterflies of eastern United States and Canada. 2: 1560-1563.



A. B.

PLATE 20

Larva and chrysalis of *Ancyloxypha numitor*, enlarged approximately x 3.

A. Dorsal aspect of mature larva. B. Ventral aspect of chrysalis.

NOTES ON THE LIFE HISTORY OF A NOCTUID MOTH

By John A. Comstock and Charles M. Dammers

Zotheca tranquilla Grote.

In spite of the relative abundance of this moth, no complete account of its entire life cycle has thus far been published.

As long ago as June of 1878, Henry Edwards in the Proceedings, California Academy of Sciences, gave an account of the mature larva. Behr, in 1885, Bulletin, California Academy of Sciences, No. 3, p. 61, records a brief and practically worthless account of the young and mature larva, in Latin.

The most complete account, to date, is that written by Dyar in Vol. 23, p. 205 of the Canadian Entomologist, but this includes only a description of the egg and last two larval stages, the cocoon, and pupa.

Our own notes cover only the last larval instar, and pupa, which have been adequately dealt with in the prior papers above mentioned. However, the figures on Plate 21 give the first published illustrations, and their inclusion herein seems therefore to be justified.

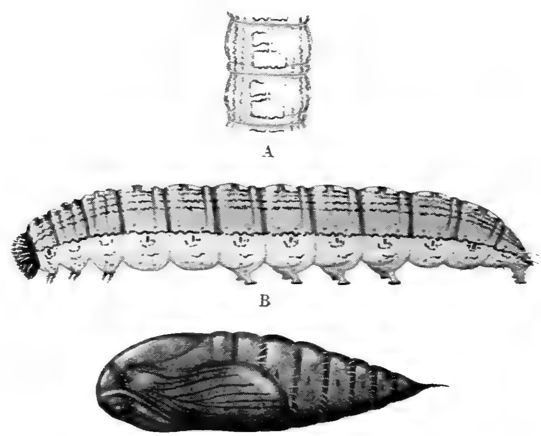


PLATE 21

Larva and pupa of *Zotheca tranquilla.*

A. Two typical segments of larva, dorsal aspect.
B. Mature larva, lateral aspect.
C. Pupa, lateral aspect. All figures enlarged x 2½.

Reproduced from painting by Comm. Charles M. Dammers

We hope at some later date to include notes on all of the larval instars.

The larvae are to be found in April, on *Sambucus* (Elder), each concealed separately in a rolled leaf, lined with silk.

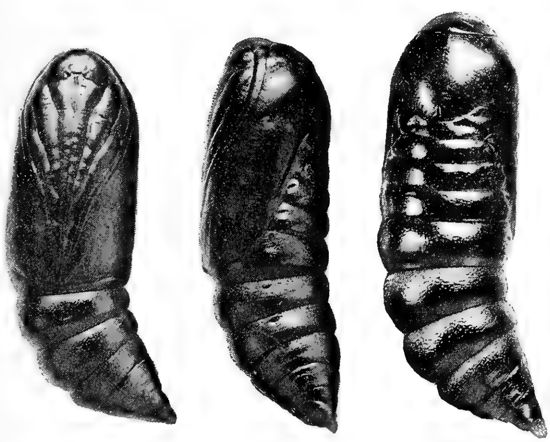
Pupation takes place in a loose silken cocoon, on the food plant.

PUPA. Length, 20 mm. Color, dark mahogany. The form is robust, with the antennae and leg cases standing out as rounded eminences. The surface is granular, or pitted over the greater part of the chrysalis, and a few short setae are present on portions of the body. The special features of the pupa are clearly shown in the illustrations on Plate 21, fig. C, and Plate 22.

The imagos emerge from early May to late June in lower altitudes. Farther north, or in higher altitudes, their time of hatching may be delayed until as late as August.

Holland states that the species ranges from northern California to British Columbia and eastward to Wyoming. We can extend that range to southern California.

The imago is illustrated in Holland's Moth Book, Plate XXVII, fig. 2. His picture is of the green form from which was named *viridula* by Grote. The typical insect is brown.



A. B. C.

PLATE 22

Pupa of *Zotheca tranquilla*, enlarged x 3.
A. Ventral aspect. B. Lateral aspect. C. Dorsal aspect.
Photographs by the late Wm. Menke

A GENERIC REVISION OF THE NORTH AMERICAN CREMASTOCHEILINI WITH DESCRIPTION OF A NEW SPECIES (Coleoptera-Scarabaeidae)

By Mont A. Cazier
University of California, Berkeley

The last comprehensive monographic paper dealing with the North American *Cremastocheilini* was that of Thomas L. Casey (1915) in which he discussed the probably origin of the tribe in North and South America, erected several new genera and constructed a key to all the known North American species. The present paper deals chiefly with this work and it is hoped that the evidence presented will aid in eventually obtaining, as nearly as possible, a correct conception of this tribe.

It is with a great deal of appreciation that I wish to express my thanks to Mr. C. W. Leng for his extensive *Cremastocheilus* collection which formed the basis for this study, to Dr. E. C. Van Dyke for loans of specimens from his collection, to Mr. E. P. Van Duzee for material loaned from the California Academy of Science and to Mr. G. J. Arrow of the British Museum of Natural History for supplying a cotype of the rare *Lissomelas flohri*. Also my thanks are due the following associates for exchanges and loans of material from their collections: L. W. Saylor, H. B. Leech, R. P. Allen, F. W. Parker, W. E. Simonds, P. C. Ting, O. H. Schwab, E. R. Leach, N. W. Frazier, E. S. Ross, J. L. Gressitt, A. P. Yearington and J. W. Johnson.

In his revision of the tribe Casey gives in the introductory paragraph (p. 340), the following hypothesis for the derivation of the American species: "Africa and North America are now, singularly enough, the principal abodes of these peculiar insects, the former doubtless being their place of origin, though some of the largest species of the tribe such as *Cyclidius elongatus,* inhabit South America, whence the North American archetypes were derived through migration in geologic time probably not so very long ago. The rupture of the south American-African land connection was much more remote in time, as shown by the complete lack of harmony prevailing between the members of the tribe now inhabiting these two continents." This conclusion is also in complete agreement with broken distribution as accounted for by Wegener's theory of continental drift, a detailed discussion of which is beyond the scope of the present paper. Herein is merely presented evidence which would tend to support the theory of the former existence of an Arctic Continent

or the derivation of the North American species from the north by way of Bering Strait.

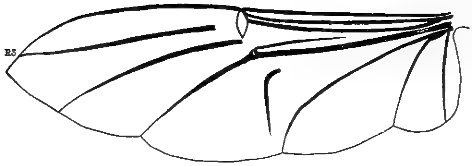
The tribe is represented in China by a number of genera, *Callinomes* being the one with which our North American and Mexican genera, *Genuchinus, Macropodina, Cremastocheilus, Trinodia, Lissomelas* and *Psilocnemis* will be compared. Inasmuch as no specimens of *Psilocnemis* were available the discussion and position given this genus will be based upon the work of others who wrote concerning it. The characters used in making this study covered most of the external morphology with special reference to the tarsi, second pair of wings, and the male genitalia. About three hundred specimens were dissected during the study and the following interesting observations made.

Morphology

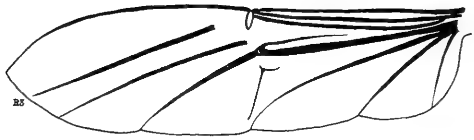
In the genus *Cremastocheilus* the following species were examined in detail: *harrisi, canaliculatus, castaneae, retractus, squamulosus, variolosus, nitens, pilosicollis, angularis, mexicanus, crinitus, knochi, tibialis, schaumi, westwoodi* and *quadratus*. Many of the Casey species omitted from this list were, I am sure, represented in the series but are not recognizable and will be dealt with in detail in a subsequent paper. The wing venation is not variable within the genus and is as shown in Plate 23, fig. 2. The male genitalis is as shown in Plate 24, figs. 1 and 2 and are monotonously the same throughout the genus. The tarsi are five-segmented in all species thus far described but the proportionate length, shape, etc. is one of the fairly specific characters. The shape, sculpturing and proportions of the prothorax are of great importance as specific characters as they undergo many modifications within the genus, *harrisi,* for instance, being entirely distinct from *quadratus* and *tibialis*.

In the genus *Trinodia* including the subgenus *Anatrinodia* the following species were examined: *saucia, hirsutus, opacula, wheeleri, planipes* and *lengi,* the last of which is a new species to be described later in this paper. The wing venation and male genitalia are exactly as they are in *Cremastocheilus* Plate 23, fig. 2 and Plate 24, figs. 1 and 2). The prothorax is trilobed in all species although much less so in *Anatrinodia*. The tarsi are five-segmented except in *lengi* which has only four segments.

The following members of the genus *Macropodina* were examined: *planata* and *ampla*. The wings and male genitalia are like those of the two preceding genera (Plate 23, fig. 2 and Plate 24, figs. 1 and 2). The prothorax is not trilobed as in *Trinodia* and closely resembles several species of *Cremastocheilus* namely *schaumi* and *knochi*. The tarsi are five-segmented with the fourth and fifth segments of the anterior tarsi dilated.



1



2

PLATE 23

Fig. 1. Hind wing of *Lissomelas flohri.*
Fig. 2. Hind wing of *Cremastocheilus angularis.*

Genuchinus angustus was examined and found to have different male genitalia (Plate 24, figs. 5 and 6) and a modification in the wing venation as shown in Plate 23, fig. 1. The tarsi are five-segmented and normal.

Lissomelas flohri has the wing venation as in *Genuchinus* but there is again a distinct modification in the male genitalia (Plate 24, figs. 3 and 4). The tarsi are five-segmented and normal.

Callinomes davides and an undetermined species in the same genus were examined and found to have the wing venation like that found in *Genuchinus* and *Lissomelas.* The male genitalia were like those of *Cremastocheilus, Macropodina* and *Trinodia.* The tarsi are four-segmented throughout the genus.

Analysis

From the above brief descriptions of the various genera it is apparent that the North American genera fall into two distinct sections as based on the wing venation. One section composed of *Genuchinus* and *Lissomelas* and the other with *Macropodina, Cremastocheilus* and *Trinodia.* The former section having vein R3 ending on the costal margin and the latter with vein R3 terminating on the membraneous posterior margin. The section composed of *Genuchinus* and *Lissomelas* also includes the Chinese *Callinomes* which, although undoubtedly distinct, is nevertheless closely allied to these North American genera. *Lissomelas* can be separated from *Callinomes* and *Genuchinus* by the genitalia as well as other external differences. *Genuchinus* can be sepa-

rated from *Callinomes* by the genitalia and by the five-segmented tarsi, thus we have in this section three distinct genera each of which is separated from the others by at least one basic morphological character plus marked external differences.

The second section of the tribe consisting of *Cremastocheilus, Macropodina, Trinodia* and its subgenus *Anatrinodia* presents quite a different picture and one which has apparently been greatly confused. The evaluation of generic characters seems to have been greatly misunderstood, due probably to the lack of long series and knowledge concerning wings, genitalia and the variability of the characters in use. The tarsi in this section are variable as can be seen from the modifications existing in the enlargement as in *Macropodina* and the reduction in number of segments to four as in *Cremastocheilus lengi.* The enlarged front tarsi in *M. planata* and *M. ampla* were used by Casey as one of the main characters upon which he established the genus *Macropodina.* In Casey's *Trinodia* group we now have *lengi* which has only four tarsal segments, and in the genus *Cremastocheilus* a number of species can be distinguished on the relative length and shape of the tarsal segments, such as *schaumi, tibialis* and *angularis.* During the course of these studies teratological specimens were found to be very much in evidence, a number having one tarsus four-segmented and the rest five, while one specimen had the tibia reduced and the tarsus two-segmented on one leg. It is therefore relatively safe to say that the tarsi do not constitute a reliable generic character in this section.

The divergence of *M. planata* and *M. ampla* from all other members of the tribe in the dilation of the fourth and fifth segments of the front tarsus, clypeus, general shape, mentum, the lateral carinae and the transverse basal fossa of the head, and the long legs prompted Casey to erect the genus *Macropodina* for these species. As has been shown the tarsi in this section are variable, the clypeus is variable as can be seen by comparing *harrisi* with *crinitus* and *wheeleri,* the value of the general shape is questionable when *quadratus* is compared with *harrisi* and is of little use generically except in associating related species within the genera. The variability in the mentum can be observed in *schaumi* and compared with that in *harrisi* which was apparently unknown to Casey who also reached an erroneous conclusion when he stated (p. 340) that these variations in *schaumi* were probably sexual. Dissected specimens in a series show all variations in both sexes. The lateral carinae and transverse basal fossa of the head, the long legs and the dilated front tarsi are therefore the only seemingly stable characters remaining. After viewing the generic characters existing elsewhere in the tribe I think that it is needless to say that *Macropodina* is not of generic value, however it will serve as an excellent subgenus of *Cremastocheilus* based on the above-mentioned characters.

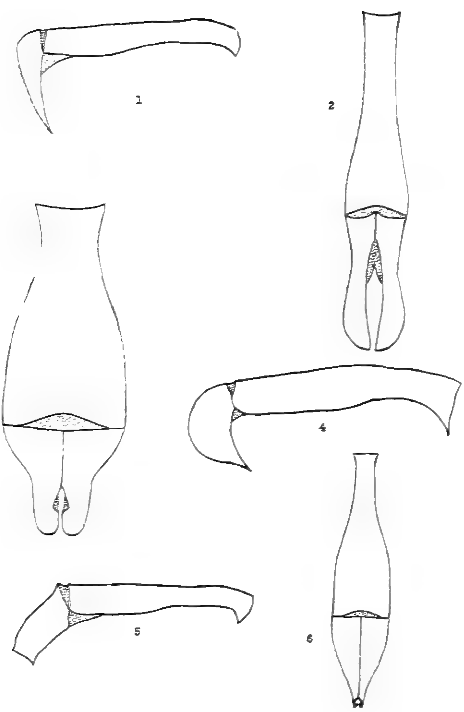


PLATE 24

Fig. 1. Male genitalia of *Cremastocheilus angularis* (side view).
Fig. 2. Male genitalia of *Cremastocheilus angularis* (dorsal and front views).
Fig. 3. Male genitalia of *Lissomelas flohri* (dorsal and front views).
Fig. 4. Male genitalia of *Lissomelas flohri* (side view).
Fig. 5. Male genitalia of *Genuchinus ineptus* (side view).
Fig. 6. Male genitalia of *Genuchinus ineptus* (dorsal and front views).

Several species of *Cremastocheilus* attracted Casey's attention with their longitudinally trilobed pronotum for which he erected the genus *Trinodia* including *saucia, spinifer, opacula, setosifrons, quadricollis, planipes* and *wheeleri.* Within this genus he discovered that *wheeleri* had the pronotal impressions from base to scarcely beyond the middle and the clypeus strongly dilated laterally as compared to the remainder of the species having the pronatal impressions continuing from base to apex, clypeus not dilated laterally but having a median carina. He, therefore, established the subgenus *Anatrinodia* for *wheeleri.*

The following is Casey's discussion of *Anatrinodia*: "Although apparently intermediate between the preceding species (referring to *planipes, quadricollis, setosifrons,* etc.) and *Cre-*

mastocheilus in many respects, and with curtailed pronotal sulci, there are so many peculiar characters pertaining to the unique type of this group, such as the remarkable abdominal structure, that it evidently should be considered as at least subgeneric in value." In a comparative discussion of the two groups the following was given: "The mentum in the first group or *Trinodia* proper is deeply concave to flat, in the latter case with reflexed hind margins; this is a conspicuous difference and is almost undoubtedly of a sexual nature; the plate is more or less sinuate at each side and at the hind margin it is entire, sometimes slightly produced medially. In the second group now represented by *wheeleri* alone, the mentum is very different; it is more transverse, deeply concave, having each side prolonged and lobiform and the hind margin is broadly bisinuate and transverse, a form of mentum which, like that of clypeus, differs from anything else known in the tribe."

It seems incredible to me that Casey could key *C. crinitus* Lec. out on page 359 by use of the clypeus etc. and then make the statements given above on page 369. The clypeus and mentum of *crinitus* are almost exactly like *wheeleri* and intermediate between *wheeleri* and other members of *Cremastochilus* proper. This is also true to some extent in *mexicanus*. As far as the difference in concavity and flatness of the mentum in *Trinodia* being sexual, I can only say that this again breaks down in *saucia* and undoubtedly would in the other species if series were available.

The remarkable abdominal structure that was considered to be of so much importance by Casey was as follows: "Abdomen very opaque, not coarsely, rather closely punctured and with short yellowish plumose hairs, closely placed throughout, the apices of all the segments bearing a dense even spongiose fringe." This character is regarded as being of great significance by Casey and yet specimens of *C. pilosicollis* from British Columbia have almost the same structure including the spongiose fringe which may extend along entire edge or for only a short distance from the lateral margins of each segment.

From the above discussion of *Anatrinodia* it is quite obvious that *wheeleri* is an intermediate between *Cremastocheilus* proper and what Casey would consider as *Trinodia*. The only character of any importance which might be used to separate the two is the presence of the pronotal impressions. This is variable as has been shown in *wheeleri* where they only extend from base to scarcely beyond the middle and also there is a great deal of modification of the prothorax in various other members of this section namely *C. harrisi, nitens, quadratus, schaumi* and *tibialis*. In view of this lack of stability and positive generic characters such as exist in other genera of the tribe, I think that both *Trinodia* and *Anatrinodia* should be suppressed as synonyms of *Cremastocheilus*.

Although no specimens of *Psilocnemis leucosticta* were available for study I am of the opinion that it properly belongs in *Genuchinus*. This opinion is based entirely upon the original description, the remarks of Casey (1915) and the discussion and illustration given by Horn (1879, 1885). The characters given by Casey for its separation are those that have already been shown to be specific and not generic and since it is undoubtedly very close I prefer to relegate it to this position.

Key to the North American Genera and Subgenera of Cremastocheilini

1. Anterior angles of prothorax each with a sinus at apex; vein R3 of hind wings terminating on membranous posterior portion of wing (Plate 23, fig. 2) 2

   Anterior angles of prothorax entire; vein R3 of hind wing terminating on costal margin (Plate 23, fig. 1) 3

2. Anterior tarsi without dilated fourth and fifth segments; head without lateral carinae .... *Cremastocheilus*

   Anterior tarsi with fourth and fifth segments dilated; head with lateral carinae .... subgenus, *Macropodina*

3. Surface of prothorax and elytra coarsely, closely punctured; tarsi without longitudinal carinae; genitalia with apex of lateral lobes truncate (Plate 24, fig. 5) .... *Genuchinus*

   Surface of prothorax and elytra smooth or with sparse, very minute punctures; tarsi sculptured with longitudinally arranged carinae; genitalia with apex of lateral lobes pointed (Plate 24, fig. 4) .... *Lissomelas*

Cremastocheilus lengi Cazier, new species.

Medium sized; head, pronotum, elytra and body beneath opaque, black, clypeus, antennal scape and legs rufous; tarsi four-segmented. Head with vertex rather densely, shallowly punctate, punctures separated by their own widths, front smooth, canthus prominent, with a dense patch of short stout hair on its free end; clypeus semi-circular, margin widely reflexed and clothed with short stout hair, strongly carinate at middle; antennae ten-segmented, scape large and flat; mentum evenly, somewhat deeply excavated, reflexed margins even throughout. Pronotum divide longitudinally into three well defined regions, anterior angles auriculate, posterior angles spiniform, widest at apical fourth, sides straight to basal angles, apical angles obtusely rounded, median region on disk irregularly, shallowly, somewhat

densely punctate, lateral regions more densely and deeply punuctured, lateral regions slightly more shining than median. Elytra flat, edges sharply reflexed, side margins subparallel, rather abruptly angulate at apices, disk with punctures in the form of elongate scratches which are arranged in more or less definite striae, some of the punctures being longitudinally connected, side margins with sparse, small punctures. Body beneath shining, sparsely clothed with short erect hair, coarse and fine punctures irregularly scattered over entire surface; legs slender, rufous, tarsi four-segmented, not greatly flattened. Male genitalia the same as in the rest of the species in the genus.

Length 10 mm., width 4 mm.

Holotype male in the author's collection. Type locality Palmerlee, Arizona, July, 1912, collected by Mr. H. A. Wenzel and given to the author by Mr. C. W. Leng after whom the species is gratefully named. Allotype female in the collection of Mr. F. H. Parker, collected at Globe, Arizona, July 13, 1937 by Mr. Parker and loaned to the author for study. Four designated male paratypes as follows: one from Nogales, Arizona, April, 1897 from the Koebele collection and one from Nogales, Arizona, April 4, 1921, collected by Mr. E. P. Van Duzee, deposited in the collection of the California Academy of Sciences; one specimen from the White Mountains, Arizona, deposited in the collection of Mr. L. W. Saylor; one from Prescott, Arizona, June 21, 1902, collected by Mr. Oslar and obtained from C. W. Leng, deposited in the collection of Mr. E. R. Leach.

There is little variation in the specimens before me. The allotype female is less opaque than the holotype and has the venter of the abdomen flat or convex rather than concave as in the males. This species has been confused in many collections with *C. opaculus* Horn from which it can be easily separated as follows: by its four-segmented tarsi which are known in no other species from North America, by the side margins of the pronotum which are straight rather than arcuate, by the shorter legs and the rufous color of the clypeus, antennal scape and legs which remain rufous throughout the six specimens of *lengi* whereas they are black in the type and one additional specimen of *opaculus* from Lower California.

Bibliography

Casey, T. L.
1915, Memoirs on the Coleoptera, 4: 340-370.

Horn, G. H.
1879, Proc. Amer. Phil. Soc., 18: 382-397.
1885, Trans. Amer. Ent. Soc., 12: 126-128.
1895, Proc. Cal. Acad. Sci., ser. 2, 5: 399.

THE Southern California Academy of Sciences announces the publication of

CHECK LIST OF THE LEPIDOPTERA OF CANADA AND THE UNITED STATES OF AMERICA

Part 1—Macrolepidoptera

By J. McDunnough, Ph.D.

which has been issued as Part 1 of Volume one of its new series of "Memoirs of the Southern California Academy of Sciences."

This publication is on sale to non-members of the Academy at $4.00.

It will be impossible for the Academy to distribute this book to individuals or institutions that are now receiving the "Bulletin" on exchange, or to Subscription Members who have subscribed for the Bulletin only.

To those individuals who wish to qualify for full membership in the Academy, the opportunity is presented of receiving the Bulletin for one year, and the McDunnough Check List of the Macrolepidoptera for the first year's membership fee of $5.00.

Additional copies of the Check List will be made available to paid up members only, at $2.00 per copy while the edition lasts. A few bound copies are obtainable at $3.00.

Bulletin subscribers who have already remitted the $2.00 subscription fee for the year 1938 may, on payment of an additional $3.00, have their names enrolled as Annual Members, and receive the McDunnough List, Part 1, without additional cost.

There has also been issued a limited number of the McDunnough Check List, printed on one side of page only, suitable for writing additional notes, which is on sale (in paper covers) at $5.00 per copy to non-members, or $2.50 to members.

Address all inquiries to

Dr. John A. Comstock, Treasurer
Southern California Academy of Sciences,
Los Angeles Museum, Exposition Park,
Los Angeles, Calif.

BULLETIN of the SOUTHERN CALIFORNIA
ACADEMY of SCIENCES

Published by the Academy at Los Angeles, California
Subscription—$2.00 per year

Free to Life Members and Unlimited Annual Members
of the Academy (Annual Membership Fee $5.00)

Address all communications to Dr. John A. Comstock

Care of Los Angeles Museum, Exposition Park,

Los Angeles, Calif., U. S. A.

PUBLICATIONS OF THE SOUTHERN CALIFORNIA ACADEMY OF SCIENCES

The Academy has published to date the following:

PROCEEDINGS, 1896 to 1899. Six numbers—Vol. 1, Nos. 1 to 6.

MISCELLANEOUS BULLETINS issued under the imprint of the Agricultural Experiment Station, 1897 to 1907. *Ten numbers.*

All issues of the above are now out of print.

● ●

Bulletin of the Southern California Academy of Sciences

Began issue with Vol. 1, No. 1, January, 1902. Issued ten numbers in 1902; nine numbers in 1903, 1904, 1905; three numbers in 1906. Issued two numbers annually from 1907 to 1919, both inclusive (except 1908—one issue only). Issued four numbers (January, May, July and October) in 1920.

The 1921 issues are: Vol. XX, No. 1, April; Vol. XX, No. 2, August; Vol. XX, No. 3, December.

The 1922 issues are: Vol. XXI, No. 1, March; Vol. XXI, No. 2, September.

The 1923 issues are: Vol. XXII, No. 1, March; No. 2, July.

The 1924 issues are: Vol. XXIII, No. 1, January-February; No. 2, March-April; No. 3, May-June; No. 4, July-August; No. 5, September-October; No. 6, November-December.

From 1925 to 1937, including volumes XXIV to XXXVI, three numbers were published each year. These were issued as No. 1, January-April; No. 2, May-August; No. 3, September-December, for each volume.

PUBLICATIONS OF THE SOUTHERN CALIFORNIA ACADEMY OF SCIENCES

For Sale at the Appended Prices

BULLETIN:

	To Members	To Non-Members
Complete set, Vols. 1 to 33, bound		$100.00
(Incomplete set) Vols. 8 to 33, bound		80.00
Vol. 3, No. 7, 1904	$ .25	.50
" 4. " 5. 1905	.25	.50
" 6. " 1. 1907 (Photostat only)	2.00	4.00
" 6. " 2. 1907	.25	.50
" 7. " 1. 1908	1.00	2.00
" 8. " 1. 1909	1.00	2.00
" 9. " 1. 1910	2.00	4.00
" 9. " 2. 1910	.75	1.50
" 10. " 1. 1911	1.00	2.00
" 10. " 2, 1911	2.00	4.00
" 11. " 2, 1912	1.00	2.00
" 12, " 1, 1913	1.00	2.00
" 15, " 2, 1916	.75	1.50
" 16, " 2, 1917	1.00	2.00
" 17, " 1, 1918	2.00	4.00
" 17, " 2, 1918	1.50	3.00
" 18, " 2, 1919	2.00	4.00
" 19, " 1, 1920	.50	1.00
" 19. " 4, 1920	.50	1.00
" 20. " 1, 1921	2.00	4.00
" 20. " 2, 1921	2.00	4.00
" 20. " 3, 1921	2.00	4.00
" 21, " 1, 1922	2.00	4.00
" 21. " 2, 1922	1.00	2.00
" 22. " 1, 1923	1.50	3.00
" 22. " 2, 1923	2.00	4.00
" 23. " 1, 2, 3, 4, 5, 6, 1924 (each)	.25	.50
" 24. " 1, 2, 3, 1925 (each)	.25	.50
" 25. " 1, 1926	2.00	4.00
" 25. " 2, 3, 1926 (each)	.25	.50
" 26. " 1, 2, 3, 1927 (each)	.25	.50
" 27. " 1, 2, 3, 1928 (each)	.25	.50
" 28. " 1, 2, 3, 1929 (each)	.25	.50
" 29. " 1, 2, 3, 1930 (each)	.25	.50
" 30. " 1, 2, 3, 1931 (each)	.25	.50
" 31. " 1, 2, 3, 1932 (each)	.25	.50
" 32. " 1, 2, 3, 1933 (each)	.25	.50
" 33. " 1, 2, 3, 1934 (each)	.25	.50
" 34. " 1, 2, 3, 1935 (each)	.25	.50
" 35. " 1, 2, 3, 1936 (each)	.25	.50
" 36. " 1, 2, 3, 1937 (each)	.25	.50
" 37. " 1, 2, 3, 1938 (each)	.25	.50

MEMOIRS:

	To Members	To Non-Members
Vol. 1. No. 1. 1938—paper cover	2.00	4.00
" " " " " bound in black fabrikoid	3.00	5.00
" " " " " printed on one side of page	3.00	5.00
" " " " " printed on one side of page (bound)	4.00	6.00

(*Continued on next page*)

Miscellaneous, Publications of Affiliated or Co-operating Organizations

Lorquinia—Vols. 1, 2 (all published)...bound $1.50, unbound $1.00

Southern California Geology and Los Angeles
Earthquakes, R. T. Hill .... bound 5.00

Southwest Science Bulletin, May 5, 1920 (all published),
chiefly Entomological, 1 colored plate 1.00

Check-list of the Recent Bivalve Molluscs (of N. W. Coast of
Am. from the Polar Sea to San Diego), W. H. Dall 1.00

Reprints:

Check-list of the Lepidoptera of Boreal America. Superfamilies Sphingoidea, Saturnioidea and Bombycoidea (printed on one side of page only, to allow of additional notes), Wm. Barnes and Foster H. Benjamin, 1927 ....$ .50

The Cacti of the Pyramid Peak Region, Dona Ana County, New Mexico, 1931. F. R. Fosberg .... .25

Check-list of the Macrolepidoptera of Canada and the United States of America by Dr. J. McDunnough, 1938, printed on white bristol board, one side of page (without index) suitable for labels. To Academy members, $1.50. To nonmembers 3.00

ADDRESS ALL INQUIRIES TO
SOUTHERN CALIFORNIA ACADEMY OF SCIENCES
(Care DR. JOHN A. COMSTOCK)
Los Angeles Museum, Exposition Park,
Los Angeles, California, U. S. A.

The work of the Southern California Academy of Sciences is carried on entirely through the generosity of private citizens, who are sufficiently interested in the advancement of education and cultural endeavor to donate funds or make bequests to the Academy. As a guide, in the matter of bequests, for those who plan to further this program, the following forms are suggested:

Form of Legacy

To be used when it is desired to leave the Academy any personal property, such as money, stocks, bonds, works of art, or other objects of value.

I give and bequeath unto "Southern California Academy of Sciences," of the City of Los Angeles, the sum of.. Dollars: To have and possess the same unto the said "Southern California Academy of Sciences," its successors and assigns, to the uses, dispositions and benefits thereof forever.

Form of Devise

To be used when it is desired to leave real estate to the Academy.

I give and devise to "Southern California Academy of Sciences" of the City of Los Angeles, (.. here describe the property or ground rent..), together with the appurtenances, in fee simple, and all policies of insurance covering said premises, whether fire, title or otherwise, free from all taxes: To have and to hold the same unto the said "Southern California Academy of Sciences," its successors or assigns forever.

REPRINTS: Contributors of articles accepted for publication in the *Bulletin* should order reprints, if desired, when they return galley proof to the Editor. They may be ordered through the Editor at the following rates, from the McBride Printing Co., 415 East Eleventh Street, Los Angeles, Calif., the contributor paying for all his reprints.

PRICE LIST OF REPRINTS

(WITHOUT COVERS)

	4pp.	8pp.	12pp.	16pp.	20pp.	24pp.	28pp.	32pp.
50 copies	$3.75	$ 5.75	$ 8.50	$10.25	$11.75	$13.50	$16.00	$17.00
100 "	4.50	7.50	10.75	12.75	15.00	17.25	20.25	21.50
150 "	5.25	9.25	13.00	15.25	18.25	21.00	24.50	26.00
200 "	6.00	11.00	15.25	17.75	21.50	24.75	28.75	30.50
250 "	6.75	12.75	17.50	20.25	24.75	28.50	33.00	35.00
300 "	7.50	14.50	19.75	22.75	28.00	32.25	37.25	39.50

Covers: 50 for $2.00—additional covers 1½c each.

California State 3% Sales Tax to be added if delivered within the state.

BULLETIN OF THE

Southern California Academy of Sciences

LOS ANGELES, CALIFORNIA

Nostra tuebimur ipsi.

Vol. XXXVII September-December, 1938 Part 3

CONTENTS

Issued January 20, 1939

Southern California Academy of Sciences

OFFICERS AND DIRECTORS

Dr. Howard R. Hill - - - - - - - - - - - - - - *President*
Dr. Ford A. Carpenter - - - - - - - - *First Vice-President*
Mr. Theodore Payne - - - - - - - *Second Vice-President*
Dr. Carl S. Knopf - - - - - - - - - - - - - - *Secretary*
Dr. John A. Comstock - - - - - - - - - - - - *Treasurer*

Dr. William A. Bryan
Dr. Ford A. Carpenter
Dr. John A. Comstock
Mr. Samuel Moody Haskins
Dr. Howard R. Hill
Dr. Carl S. Knopf
Mr. Theodore Payne
Mr. Harry K. Sargent
Mr. William A. Spalding
Dr. R. H. Swift
Dr. D. L. Tasker

ADVISORY BOARD

Mr. Fred E. Burlew
Dr. Chester Stock

ASTRONOMICAL SECTION

Mr. Harry K. Sargent
Mr. William A. Spalding

BOTANICAL SECTION

Mr. Theodore Payne, *Secretary*

ARCHEOLOGICAL SECTION

Dr. Carl S. Knopf
Dr. R. H. Swift

FINANCE COMMITTEE

Mr. William A. Spalding
Mr. Samuel Moody Haskins

PROGRAM COMMITTEE

Dr. Howard R. Hill, *Chairman*
Dr. John A. Comstock
Dr. Carl S. Knopf

COMMITTEE ON PUBLICATION

Mr. William A. Spalding, *Chairman*
Dr. John A. Comstock

Office of the Academy
Los Angeles Museum, Exposition Park, Los Angeles, Cal.

THE FAUNA AND FLORA OF THE EL SEGUNDO SAND DUNES

1. GENERAL ECOLOGY OF THE DUNES

By W. Dwight Pierce and Dorothy Pool

One of the most interesting limited zones for the study of the interrelationships of life with environment, in the vicinity of Los Angeles, is the stretch of sand dunes bordering the coast between Playa del Rey and El Segundo.

The writers began a joint study of the life on these dunes and immediately adjoining them, in January, 1938, and have continued the studies more or less weekly since then. We have been ably assisted at various times by Charles A. Fleschner, Mrs. Pierce, Dr. Robert Rutherford, Miss Frances Cramer, Miss Bonnie Templeton, Frank Cramer, Robert Perkins, Owen Nichols Jr. and G. F. Augustson.

Miss Templeton has kindly reviewed the botanical determinations and will make interesting contributions to the series of articles.

Dr. Rutherford has taken beautiful color slides of the plant life for use in lectures. Other photographic studies have been made by Robert Perkins, and the senior author. E. S. Cobb, photographer of the Los Angeles Museum, has made excellent photographic studies of numerous species, which will illustrate the life history articles, to be contributed to this series.

Rather than wait until we can make a complete and exhaustive study, we feel that the results should be published in one series as rapidly as they can be adequately prepared.

The dunes lie north and south, parallel to the shore and just back of the strand, stretching inland the distance of several city blocks, and in some cases reaching a height of almost 200 feet above sea level, especially on the meadow side, where the ascent is very abrupt. Crossing the dunes are ravines, which in some cases were probably started by trails of people going to the shore. These ravines are in many cases quite deep. New dunes often grow in the opening of a ravine, completely enclosing it, sometimes in a bowl formation.

Here and there on the coastal margin, between the strand and the moving dunes are established zones, where plant life has anchored the sands. These zones are also to be found in some of the ravines and bowls. But advancing dunes encroach on these areas until they are finally completely covered.

A number of definite areas for biological study may be defined:

1. The beach below high tide, on which no plants grow.

2. The strand, on which hardy plants with considerable saline tolerance encroach to the very edge of the water line.

3. The railroad track on the strand, where certain ruderal intruders have become established.

4. The clay embankment or permanent shore line, in which many burrowing forms of life are found, and on which several species of *Mesembrianthemum* have been established.

5. Foredune established areas.

6. The roadside, along which many ruderal species are found.

7. Ravine and bowl established areas.

8. Moving dunes.

9. Dune complex areas, where plant life is becoming established.

10. The landward slope.

11. An old sewage dump on top.

12. The meadow base of the dune.

13. The meadow sloping downward to the dune.

In each of these we have found some plant species not found elsewhere. Of course this means that the insect and other life is also in like manner limited.

The dramas of life are fully illustrated in this interesting region, which is only about one mile long. Here wind and sand, and salt-saturated air, frequent heavy fogs, and shortage of soil water and soil nutriment have brought about many hazards to life, of both plant and animal.

The plants have met the challenges of nature with low growth, increased water storage capacity, fleshy leaves, reduced leaf surface, thickened cuticle, production of spines, dense stellate or wooly pubescence, scurfiness, development of adhesive hairs, the ability to keep on growing up through the encroaching sands, each in its own way.

The insect life has had to meet these challenges of spines adhesive hairs, mats of pubescence, thickened cuticle, sticky juices, and encroaching sand, and many of the results are exceedingly interesting. The species are dominantly small to tiny often wingless, but life is abundant. Primitive forms of insects and other arthropods are much more common than ordinarily found. Mites and spiders, myriapods, and pseudoscorpions abound. Many of the insects and spiders have taken to forming tubes or balls of silk covered with sand, for their protection

The plant life on the meadow side and the shore side is quite different, with only a few plants common to both. As one approaches the dune base from the meadow a sharp demarking line, at the very bottom of the slope, is made by the vegetation.

The winds blow, and the loose sands drift, covering up the existing life. Through this strangling sand cover, the tender branches of *Franseria bipinnatifida* struggle up to the light, and from the long covered stolons of the morning glory, *Convolvulus soldanella,* spring up new shoots. Seedlings of Russian thistle, *Salsola kali,* obtain a hold, and there appear plants of *Oenothera cheiranthefolia suffruticosa.* These and a few other plants start off the life on the new dune.

Other plants get a foothold, and the sand becomes dotted with life. But almost as soon as the first leaves appear, the insects and mites, the millipedes and centipedes are at hand to begin feeding on the tender new life. The plant grows, flowers and fruits. It has lived its life for the season, but long before this life is completed, the disintegrators have started their work of returning the plant to the soil.

Almost every plant on the dune has borers in the stems, which reduce the tissues finally to dust. Termites are everywhere, entering bored stems and completing the destruction of the living plant, reducing it to dust, which makes plant food for the later plants in the series. This plant dust becomes a part of the deposits in the ravines, which makes it possible for the less hardy plants to obtain nourishment.

The insect world multiplies, until not a plant can be found that does not have its characteristic insects. Yet they are not allowed to become too abundant, for many species of parasites and predators are active, and in the forefront of these are the tiny globular mites, *Pediculoides ventricosus,* which can produce, very conservatively a hundred million offspring in a month, for they have a generation of about twenty-five every four days. If they had full, unlimited sway, nothing else could live, but there are also multitudes of predaceous mites, and other mite-eating predators.

Thus life is converted into life, and life into inert matter, upon which new life is nourished. Truly, the biotic factors at work on the dune are as many as the forms of life present.

It shall be our task in the papers to follow, to tell of some of these interesting life dramas, that transpire in this small area, which many people see and few investigate.

There is one unfortunate factor, which modifies the life on the dunes to some extent. It is the natural picnicking ground for many people, who carelessly litter the sand with tin cans, bottles, waste paper and lunch debris. The winds cover these hu-

man wastes with sand, but they remain to change the microbiotic conditions for the dune life. An accumulation of waste paper caught in a cactus clump becomes a convenient harbor for black widow spiders, *Latrodectes mactans,* and their egg masses. Each tin can and bottle, each charred piece of wood remaining from a bonfire, becomes a place of harbor for some creature as it hides from the merciless sun.

The most completely changed area of all is one small section on top, where the city sewage after treatment was at one time dumped. Here the soil is rich but poorly covered with sand, and several plants have been found that were not located elsewhere.

Insects have been collected on every plant studied, but it may take a long time before we can finish our lists for all of them.

At the present time (November 15, 1938) a total of 108 species of plants, exclusive of fungi, have been observed by various students, including ourselves, from this zone. We have personally seen 75 species of plants, and made collections on 62 species. Of these 20 have not been previously listed from this area. In a number of cases the specific identity of the observed plants is subject of inquiry, and these we will not yet cite.

The plants of the meadow, which reach to the very edge of the dune, but have not yet been seen to intrude upon the pure sand slopes are as follows: ragweed, *Ambrosia psilostachya; Gnaphalium microcephalum; Eremocarpus setigerus; Lotus americanus; Sidalcea malvaeflora; Oenothera bistorta; Polygonum aviculare;* and *Orthocarpus purpurascens.*

At the very edge of the dune only, we find a thin line of *Potentilla lindleyi.*

The following plants are found intruding from the meadow onto the dune: *Chaenactis glabriuscula* var. *curta,* an annual, generally distributed over the dunes, and on the meadow; *Corethrogyne filaginifolia* var. *pacifica,* sparingly distributed over dunes, common on meadow; *Gnaphalium decurrens,* an annual, sparingly all over the dunes; *Heterotheca grandiflora,* in stabilized areas, ravines, at both slope bases, and sparingly on the dunes; *Stephanomeria exigua* var. *coronaria,* an annual of low stature, on meadow, stabilized areas of foredune, and in dune ravines; *S. virgata,* growing much taller, only in stabilized areas, especially on seaward side; the dodder, *Cuscuta californica,* parasitic on various plants on the dune, but especially on *Croton* and *Oenothera; Brassica campestris,* scarce on dune, common on the meadow at base; the wall flower, *Erysimum asperum,* found all over the dune complex; wild radish, *Raphanus sativus,* an annual, on the meadow slope of dune to top, and

in stabilized areas on seaward side; Bermuda grass, *Cynodon dactylon,* on meadow base, in old dump area, and in stabilized areas and ravines; *Lotus scoparius,* all over dune and meadow; *Eriogonum gracile,* sparse on dune, common at meadow base; *Datura meteloides,* on meadow and in established zones; *Atriplex semibaccata,* and others to be listed later.

Along the shore road at the foot of the dunes are the following plants, which do not appear elsewhere: *Aster exilis, Helianthus annuus, Sonchus oleraceus, Melilotus indica, Anagallis arvensis,* and a few others to be reported later.

On the sandy right-of-way of the railroad at the edge of the strand we find *Heliotropium curassavicum,* and nowhere else.

The true dune plants, which do not appear on the meadows, belong to three categories:

The pioneers: *Atriplex leucophylla,* found only on the strand at edge of high water line; *Salsola kali,* well distributed over whole dune area; *Franseria bipinnatifida,* perennial, evergreen, principally on moving dunes; *Convolvulus soldanella,* only on seaward slope, down to water's edge; *Dithyrea californica* var. *maritima,* on moving dune; the verbenas, *Abronia maritima,* on seaward side; *A. umbellata,* on the entire dune area; and a parasitic plant reported in another article of the series by Miss Templeton.

The dune complex, or semi-established zone plants: *Ericameria ericoides,* perennial evergreen; bluff letuce, *Cotyledon farinosa,* scattered all over the dune area; *Tillaea erecta,* a very minute plant, which grows in mats; *Echinocystis fabacea,* an annual vine; *Croton californicus* var. *tenuis,* a perennial; *Lupinus chamissonis,* perennial, evergreen; *Oenothera cheiranthefolia* var. *suffruticosa,* perennial; and *Galium angustifolium,* perennial.

The established zone plants, on foredune, and in ravines and bowls, and on the shore banks: the sea fig, *Mesembrianthemum aequilaterale;* the ice plant, *M. crystallinum,* and the Hottentot fig, *M. edule,* all growing in great beds, perennial, but often dying back in dry places; the lemonade berry, *Rhus integrifolium,* growing in dense clumps, perennial, evergreen; the prickly pear, *Opuntia occidentalis littoralis,* perennial, evergreen; burrofat, *Isomeris arborea,* growing near *Rhus* clumps; *Atriplex parishii; Chenopodium album; Rafinesquia californica,* on foredune only; *Cucurbita foetidissima,* in ravines, on moving dunes, and meadow slope; sandbur, *Cenchrus pauciflora; Mirabilis laevis californicus; Solanum nigrum.*

We hope to discuss later the insect fauna of each of these plants.

2. A NEW SPECIES OF PHOLISMA

By Bonnie C. Templeton

Pholisma Nutt.

Inflorescence spike-like; stamens and stigma even .... *P. arenarium* Nutt.

Inflorescence paniculate; stigma exserted beyond stamens

Stems solitary .... *P. depressum* Greene

Stems branched .... *P. paniculatum* sp. nov.

Herba succulenta; caulis 2-8 dm., ramosus ex infima parte, squamosus; squami ovato-lanceolati, acuti, sparsi; inflorescentia corymboso-paniculata, laxe ramosa ad compacta, formans paniculam convexam dense multiplicem, 3-10 cm. in diametro; flores bracteati, secundi. Corolla 7-12 mm. raripilosa glandulosa, tubulo-infundubuliforma, rotata 4-6 mm. in diametro, violacea purpurea albo marginata; calyx profunde 5-7 partitus, laciniis lineari-filiformis, dense glanduloso-pubescens; stamina 5, variabiles (5-7) inserta ad aut infra faucem; filamenta minuta, 1 mm. longa; stigma exsertum $\frac{1}{3}$ - $\frac{1}{4}$ parte longitudinis styli supra stamina.

Pholisma paniculatum sp. nov.

Stems succulent, branched from the base, 2-8 dm. tall; scales on stem ovate-lanceolate, acute, sparse, spirally arranged; inflorescence corymbose-paniculate, loosely branched to very compact, forming a convex compound panicle 3-10 cm. in diameter; flowers bracteated, secund; corolla, glandular hairy, 7-12 mm. long, tubular-funnelform, limb rotate 4-6 mm. broad, deep purple with white border. Sepals 5-7, linear-filiform, densely glandular pubescent. Stamens variable (5-7), mostly 5, inserted at or below the throat; filiments minute, about 1 mm. long; stigma exserted $\frac{1}{3}$ to $\frac{1}{4}$ the length of its style beyond the stamens.

Type locality: El Segundo, California.

Type specimen: Templeton No. 4588, deposited in Type Collection at the Los Angeles Museum under herbarium No. 23431. Collected August 10, 1938.

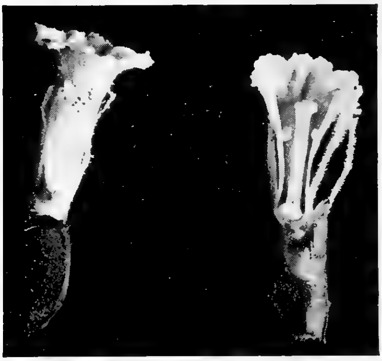
Sand dunes, El Segundo, Playa del Rey, Santa Monica, Moro Bay, San Luis Obispo.

Parasitic upon roots of *Eriogonum parvifolium* and *Croton californicus*.

PLATE 25

Pholisma paniculatum, ½ natural size.

a. Compact panicle. *b.* vertical section of compound panicle, showing branching and secund arrangement of flowers. *c.* Loosely branched panicle, again showing secund arrangement of flowers. *d.* Complete plant showing convex compound panicle. *e.* One of nine branches on a stem, each maturing into a panicle as in "*a*".



A. B.

PLATE 26

Pholisma paniculatum flower, enlarged x 2¼.

A. Flower showing glandular hairlines on calyx and outside of limb of corolla.

B. Vertical section of flower showing the extent to which the stigma protrudes beyond stamens, and also the subtending bract.

---

3. A NEW BOTANICAL RECORD FOR CALIFORNIA

By Bonnie C. Templeton

Plantago indica L. (*Plantago arenaria* W. & K.)

The plants were found growing densely in the stabilized areas of the El Segundo sand dunes. This species should not be confused with *P. psyllium* L., which has its lower bracts short acuminate simply carinated while those of *P. indica* L. are long acuminate and the carina is scarcely distinguished from the lamina.

Robt. Pilger, in his revision of the genus *Plantago* in Pflanzenreich IV, June, 1937, page 418, reduced *Plantago arenaria* W. & K. to a synonym of *P. indica* L. This plant was first collected in this area August 4 of this year (1938).

4. THE BLACK WIDOW SPIDER AND ITS PARASITES

By W. Dwight Pierce, Ph.D.

The black widow, *Latrodectes mactans* (Fabricius) has attracted, justly, much attention in California in late years, because of its growing abundance, and the numerous cases of serious, often fatal bites. An excellent bulletin on its life history was published by W. B. Herms, S. F. Bailey and Barbara McIvor as Bulletin 591, California Experiment Station.

Three parasites have been recorded: a chloropid fly, *Pseudogaurax signata* (Loew) (*Gaurax araneae Coquillett*), found in California, which deposits its eggs on the outside of the egg sac, and the larvae entering, feed upon the spider eggs; an ichneumonid, *Gelis* sp., found in California, which is also a predator in its larval stage; and a scelionid, *Baeus latrodecti* Dozier, of Haiti, which has not been found elsewhere.

Our work on the sand dunes, in which Dorothy Pool and Charles A. Fleschner were associated, has resulted in finding the *Pseudogaurax* and a new *Baeus* parasitizing the black widow egg balls, which are very numerous in clumps of cactus, *Opuntia occidentalis littoralis*. The *Pseudogaurax* is already known in Los Angeles County, through the excellent work of George Elwood Jenks, who published a beautiful series of photographs in Natural History for June, 1938.

The *Baeus* is a tiny creature with wingless female, and winged male. The female might have great difficulty reaching spider egg balls, if it were not for the fact that she is a great jumper, being able to jump at least two inches, which is over 65 times her length. For this purpose her hind legs are considerably longer than her body.

Dozier was able to keep *Baeus latrodecti* females alive eight days, and males four days. We have done better with *B. californicus*. On August 12, 1938, a lot of parasites issued, and many were alive ten days later, the last one dying on the fourteenth day having received no food whatever. An egg capsule collected August 17 yielded parasites on August 24, and some were alive ten days later when a mite infestation necessitated fumigation and loss of the colony.

In all, between August 10 and 24, 38 egg balls were found in cactus clumps on the dunes. Of these all but five had hatched, but examination of the balls readily discloses whether parasites had been present. *Baeus californicus* was bred from two of the five balls.

By direct observation of parasites entering the balls, and also of finding adults in a ball in which no eggs had yet hatched, we know that the female cuts her way into an egg ball and parasitizes the eggs. She must oviposit separately in each egg, and from the observations noted below it will be seen that she does this very effectively.

The finding of an egg ball with a hole in it does not prove that the spiders have issued. If the ball is heavy it is probably parasitized.

Of the 38 balls, 26 were unparasitized, while 9 yielded *Baeus californicus* (23.7%), and 2 *Pseudogaurax signata* (5.2%), a total of 28.9% parasitism of balls.

But the parasitism within a ball is not necessarily complete. The *Pseudogaurax* fly oviposits on the outside, and the larvae must penetrate the egg ball and consume the eggs; in one case 11 flies, and in the other 28 issued, but the evidences showed that many spiders also issued, and I calculated less than 50% parasitism.

The *Baeus* has a better record, as we obtained in the cases counted 401 out of 403 (99.5%); 278 (100%); 207 (100%); 236 (100%); 396 out of 408 (97.05%); 274 out of 279 (98.20%); 232 out of 248 (93.54%); and 361 (100%); a total of 2,385 out of 2,420 (98.55%). Thus the number of eggs per ball ranged 207 to 408.

Thus it can be seen that *Baeus californicus* and its relative *B. latrodecti* are the most effective parasites of the black widow yet known, and we can hardly expect greater effectiveness within an egg ball than 98.55%, although we do expect the percentage of parasitized balls to increase.

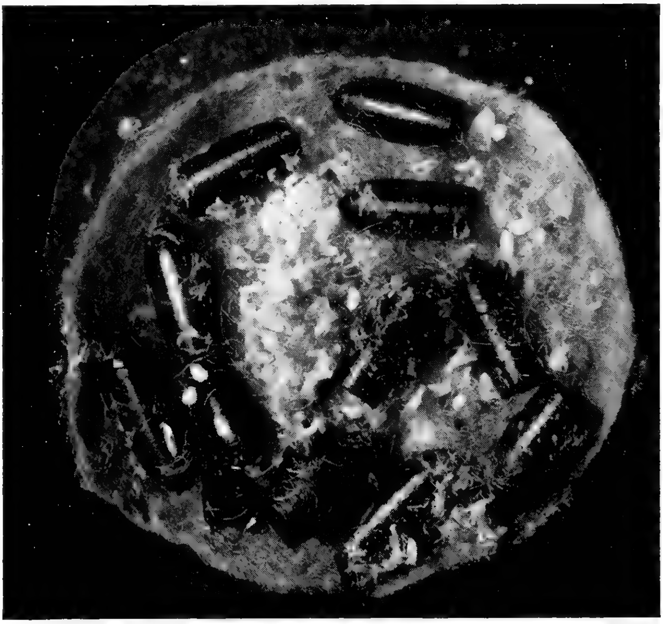


PLATE 27
Section of egg ball of *Latrodectes mactans* with empty puparia of *Pseudogaurax signata*. Enlarged approx. x 7.
Photo by Cobb.

The females greatly outnumber the males, by about 10 to 1 (264 to 25 in observed case), and the females seem to issue first, but copulation was observed immediately after emergence, and it is quite probable that many are fertilized before coming out.

An attempt will be made to propagate this valuable parasite.

Description of the new species:

Baeus californicus n. sp.

A parasite of the eggs of the black widow spider, *Latrodectes mactans* (Fabricius), found on the sand dunes at El Segundo, Los Angeles County, California. Type material found by Charles A. Fleschner, Dorothy Pool and W. Dwight Pierce.

PLATE 28
Eggs of *Latrodectes mactans* from which *Baeus californicus* as issuing. Magnified approx. x 15.
Photo by Cobb.

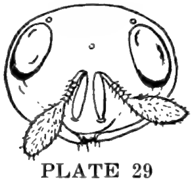


PLATE 29
Face of female *Baeus californicus*.
Magnified approx. x 77.

This species is slightly larger, darker and quite differently proportioned from *Baeus latrodecti* Dozier, a parasite of the same spider in Haiti; and it differs from *B. minutus* Ashmead, *B. niger* Ashmead, *B. piceus* Ashmead, *B. clavatus* Provancher, and *B. americanus* Howard, all spider egg parasites, by virtue of its lengthened first funicular joint, as well as other characters.

Female: Length 0.766 mm., breadth of head 0.55 mm.; breadth of thorax 0.45 mm.; breadth of abdomen 0.55 mm.; dorsal length of head 0.6 mm., thorax 0.3 mm., abdomen 0.36 mm.; length of antennal scape 0.166 mm., funicle 0.141 mm., club 0.175 mm.; width of club 0.0766 mm. Thus the club is decidedly shorter than the combined scape and funicle. In general, the color of the head, thorax and venter (using Ridgway color standards) is walnut brown; eyes black; abdomen dark Vandyke brown; antennal club and legs cinnamon buff to cinnamon and ochraceous tawny; scape and funicle almost concolorous with head, except that the apical half of the first funicular joint is almost black. Face broadly elliptical, eyes ovoidal, granulate facetted; surface of head finely reticulately carved, with three ocelli, the lateral ones adjoining vertigial margin of eyes. Antennae seven-jointed, with stout scape, 5-jointed funicle with first joint almost as long as the four following moniliform joints; club oval; each funicular joint bearing fine apical hairs, and club sparsely clothed with fine white hairs.

Prothorax a narrow band; mesothorax large, metathorax very narrow. The surface of thorax and abdomen is finely reticulate and sparsely setose. The legs being used for jumping, are longer than the body; the anterior measuring 0.86 mm., median 0.93 mm., and posterior 1.08 mm. The posterior femora are toothed at inner apex, tibiae elongate, first tarsal about as long as second and third together, claws very slender.

The first two abdominal segments are very narrow, the abdomen being mainly composed of the third segment. The posterior abdominal segments are fringed with white hairs.

Male: Length 1.083 mm.; divided as head 0.166 mm., thorax 0.5 mm., abdomen 0.416 mm.; length of antennal scape 0.141 mm., funicle 0.40 mm., club 0.010 mm. The male is darker than the female, with eyes and dorsum of thorax black; face, sides and venter of thorax, and abdomen Kaiser brown; antennae and legs clear antimony yellow.

The antennae appear to be only 11-jointed, the funicle being composed of 9 joints, of which the first is longest, the second next, the third the only one not longer than broad; the club is but slightly wider and 1-jointed.

The venation is as described for *B. latrodecti*.

The holotype female and allotype male and numerous paratypes are deposited in the collection of the Los Angeles Museum of History, Science and Art, while paratypes will also be distributed to other museums.

STUDIES IN THE METAMORPHOSES OF SIX CALIFORNIA MOTHS

By John A. Comstock and Charles M. Dammers

Erinnyis ello L.

The early stages of this Sphinx moth have been described by numerous writers in several publications, most of which are not available to the average American student. These references are noted in our bibliographic footnote.

Henry Edwards' description in Entomol. Amer.[8] covers the fourth and fifth instars, and the prior description by Dr. Holland in the Canadian Entomologist[6] gives the mature larva in both of its color phases, and corrects some misconceptions of earlier writers. There are, however, no available illustrations, and our own rearing of the species enables us to somewhat amplify the previously published records.

This insect has a wide range through tropical America and extends northward along the eastern seaboard into Florida. Strays have been taken as far north as New York and Massachusetts, but it is doubtful if it overwinters north of the frost line.

The larva is dichromatic, there being a green and a brown form. In California the green form predominates, if we may judge from our somewhat inadequate breeding experiments.

The authors were fortunate this year (1938) in being presented with two lots of larvae, the first, taken in San Diego by Capt. W. P. Medlar, and the second (six examples) received from Mr. and Mrs. Carl W. Kirkwood of Santa Barbara. Both lots were taken on Poinsettia.

Egg: This has been described as "dark green, deposited on the under side of the leaves of the foodplant."

Larva; first instar. Holland describes this as "purplish brown."

Larva of 13 mm. length.

Body, green. Mid-dorsally there is a broad longitudinal band of very dark green, bordered laterally with narrow yellowish margins.

The lateral and abdominal surfaces are clear green. The entire body is covered with small round white dots.

Caudal horn 3 mm. long, slightly upcurved, and of a black shade.

Legs, greenish, tinged with reddish brown. Prolegs, green. Anal prolegs green, tinged with orange.

Head, green, with a slight russet cast.

Duration of instar, four days.

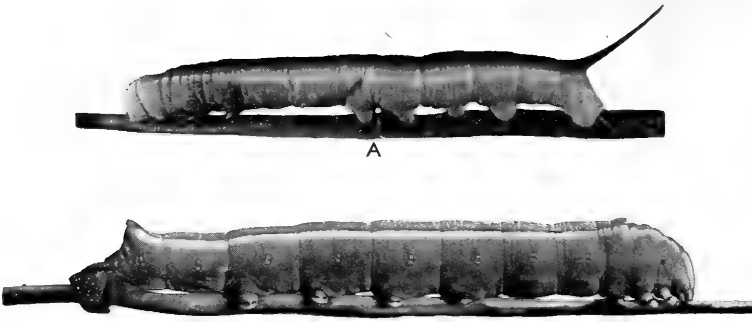


PLATE 30

Larva of *Erinnyis ello.*

Fig. A. Larva of 13 mm. enlarged x approx. 5.
Fig. B. Mature larva, lateral aspect, life size.

Photo by Cobb.

PLATE 31
Mature larva of *Erinnyis ello*, dorsal aspect, life size.
Photo by Cobb.

Larva of 18 mm. Head width, 1.90 mm.

Body predominantly green, the dorsal area bluish green, and the lateral and abdominal surfaces yellow-green. The longitudinal stripe separating these areas is less clearly defined than in later instars. Round white punctae cover the body surfaces as in the prior instar.

The caudal horn is 3 mm. in length, and is of a rosy tinge with a bright rose area at the base.

Legs, pink. Prolegs, green, tinged with rose. Anal prolegs, green.

Spiracles, white, with a pink bar transversely across the center.

Head, green.

Duration of instar, four days.

Larva of 25 mm. Head width, 2.70 mm.

Body, deep green, profusely speckled with small round white dots.

Dorso-laterally a longitudinal lemon-yellow stripe runs the entire length of the larva. This begins on the cheeks and ends at the base of the caudal horn. On its upper edge it is narrowly etched with a row of black dots or dashes, giving the appearance of a narrow black band.

Across the shoulder of the third segment is a transverse saddle, which stretches between the two narrow yellow longitudinal stripes.

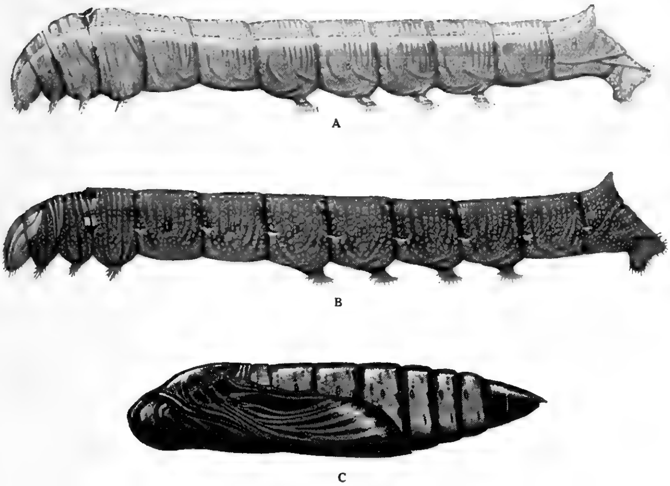


PLATE 32
Larvae and pupa of *Erinnyis ello*, approximately life size, viewed in lateral aspect.
A. Green form. B. Brown form. C. Pupa.
Reproduced from painting by Comm. Charles M. Dammers.

This is frequently obscured by the deep crease formed between the second and third segments. This saddle is checkered, with a pair of bright pink quadrate spots on its lateral ends, and a large kite-shaped black spot in the center, the remainder of the bar being yellow. There is considerable variation in this "saddle." A very narrow dark mid-dorsal stripe starts at the back of the head and extends to a point slightly caudal to the checkered bar above described.

The caudal horn nearly black, with a tinge of pink on the shaft, and a rich pink on the basal one-sixth. It measures 5 mm. in length.

Legs, pink. Prolegs and anal prolegs, green.

Spiracles, long and narrow ovals; soiled white, with a brown spot across the middle.

Head, green, with a prominent yellow bar diagonally crossing each cheek, this bar being a direct continuation of the narrow longitudinal band on the body.

Duration of instar, seven days.

Larva of 40 mm. length. Head approximately 3.75 mm. wide.

The color and markings are the same as for the prior instar except for the following points:

Caudal horn, pink at the base, shading to yellow at the tip. Length, 3.5 mm.

A. B. C.

PLATE 33

Pupa of *Erinnyis ello*. Figures slightly enlarged.
A. Lateral aspect. B. Ventral aspect. C. Dorsal aspect.
Photo by Cobb.

Legs, pink, with a black transverse bar at the edge of each segment. Prolegs, blue on the proximal segment; pink on the middle segment, which is crossed transversely by a black bar. The portion above this bar has a number of white punctae scattered over its surface. The distal segment is soiled yellow. Anal proleg, green except for a pink spot on its lower anterior edge.

Mature larva. Length, 75 to 84 mm. Head width, 4.3 mm.

Head and body predominantly green. The dorsal area is a blue-green slightly tinged with mauve. The lateral and abdominal areas are a deep apple green. The longitudinal stripe separating these areas is a pale yellow (nearly white in one example) and is etched along its medial border with black dashes, as in previous instar. This pale yellow stripe is carried forward onto the cheek. In the majority of our examples it varied from a very light yellow to white, the remainder of the head being green.

The prominent saddle across the front of the third segment is present, as in prior instar, but is somewhat modified in color.

The shield-shaped central black spot is bisected by a narrow irregular blue stripe. Posterior to the "shield" is a transverse bar of mauve, and lateral to it an area of amber. As previously mentioned, there is considerable variation in the color of this saddle in different individuals.

One example had a transverse mauve bar crossing the front edge of the second segment.

The caudal horn is completely absent except for an elevated button, the tip of which is pale brown or mauve.

A few examples show a large white spot on the front of each segment, placed in line with the stigmata or slightly inferior thereto.

The lower half of the head is sparingly covered with colorless hairs, and similar hairs occur on the anal flap and anal prolegs where they arise from small white raised points.

Spiracles, white, with a mauve or light brown bar across the center.

Legs, white with black bands at the joints. Prolegs; proximal segments velvety black shading to bluish at the margins; middle segments rose, shading to whitish at the distal edges and crossed transversely at about the centers by a narrow brownish black line; distal segments mauve. Claspers, black.

Duration of instar, ten days.

In the alternate type of this larva the color is predominantly brown, and persists from the first instar through to the final stage. Our own single example was an olive-gray, and the color appeared only in the last instar. Its description follows.

Olive-gray type. Body, pale blue-gray. Subdorsally a broken black line runs from the second segment to the caudal tubercle. The entire body except the top of the first segment and the anal flap is covered with pale lemon round dots, some of which are edged with black.

A white patch across each segmental joint constitutes the overlap. Irregular pale olive patches occur laterally on each segment.

Anal flap and anal prolegs, pale brown, spotted with white and flecked with brown. Legs, pale pink, with two black bars crossing each leg. Prolegs, blue-gray, with a black patch at the proximal juncture. Spiracles, soiled white, with brown rims and a brown bar across the center.

The rear fold of the first segment and the two front folds of the second segment are lemon below the black line, and the top of the second segment is olive-brown. Mid dorsally at the junction of the second and third segments there is a large oval black spot with a white mid-dorsal stripe. This spot is edged with white and surrounded with amber. Below this is lemon, then olive, then lemon, and finally brown.

The caudal horn is pale brown, with a pink circlet at its base.

Head, pale buff, with three olive-brown bands across each side. The coloring of the head is continued onto a shield which tops the first segment. Ocelli, brown. Mouth parts, olive.

Pupation occurs in the debris at the base of the foodplant.

Pupa; length, 52 mm.

Head, thorax and wing cases, brown, heavily striped and spotted with black. The legs, antennae and venules of the wings are striped with black.

Body, pale chestnut, the segmental joints bordered with black.

The upper half of the body has three lines of black dots longitudinally along the dorsum. The last two segments are black.

Spiracles, black. Cremaster somewhat heart shaped, and flattened dorso-ventrally.

The first imago from our Santa Barbara lot emerged October 15, 1938, and the first of the San Diego lot appeared on November 28.

All examples carried through to maturity without mishap, and no parasites were recovered.

On Plate 30 the very young larva shown in the upper figure had a diagonal scar on its side, which shows clearly in the cut. It was suspected that this was the result of a parasite. However, the scar persisted through all of the subsequent instars, and the resultant chrysalis gave forth a normal imago.

The larval foodplants are Poinsettia, Psidium and *Euphorbia heterophylla*.

BIBLIOGRAPHY

1. Larva, pupa. (col'd. figs.) Madame Merian, Insects of Surinam, 1719.
2. Larva. Harris. Silliman's Journal Sci. & Art, vol. 36, p. 297, 1839.
3. Larva, pupa. Clemens. Journ. Acad. Nat. Sci. Phila. 1859.
4. Larva, pupa. Morris. Synops. Lep. No. Am., p. 201, 1862.
5. Larva. Boisduval. Spec. Gen., Shingidae, p. 120, 1874.
6. Egg, larva. Holland, W. J. Can. Ent., vol. 18, p. 103, 1886.
7. Larva, pupa. Gundlach. Entom. Cubana, p. 223, 1886.
8. Larval stages, pupa. Edwards, Henry. Entomol. Amer., vol. 3, p. 166, 1887.

Hemileuca nevadensis californica W. G. Wright

Captain Stretch first described *H. nevadensis*[1] from examples taken at Dayton, Nevada. In 1888 Wm. G. Wright published *H. californica* in the Canadian Entomologist,[2] basing the subspecies chiefly on the fact that in the Nevada form the discal area is pale yellowish whereas in *californica* this area is white. It

must be remembered however that when he first recorded his "species" he was unfamiliar with Stretch's species, and his differentiation between the two was drawn at a much later date in his "Butterflies of the West Coast."

PLATE 34
Egg of *Hemileuca nevadensis californica* magnified x approx. 16.

Reproduced from painting by Comm. Charles M. Dammers.

In his original publication[2] Wright discussed the habits of *californica,* and gave a brief description of the mature larva.

Prof. French, in 1894,[3] described the egg and first three larval instars.

In 1895 Dyar[4] discussed the characteristic arrangement of the tubercles and setae, pointing out the fact that the placement of these was exactly as in the genus *Pseudohazis,* and figuring the spines on certain typical segments.

Packard, in his treatment of *H. nevadensis*[5] described a new form (*artemis*), which all authorities now agree is synonymous with *nevadensis,* and of which he gave a complete description of the mature larva with colored figures (Plate XXIII) of several instars.

Dyar's brief note in Proc. U. S. Nat'l Mus.[6] on the larva of *nevadensis* is interesting in that it records the species at Denver, Colorado, in association with the eastern *H. maia.*

Henry Edward's description of the mature larva of *"nevadensis"* published in 1875[7] undoubtedly refers to *californica,* as his larvae were taken in Fresno, California. The same can be said of Hulst's description in Entomologica America,[8] since his larvae were taken at San Bernardino, California.

A

B

PLATE 35
Larva and pupa of *Hemileuca nevadensis californica,* enlarged x 1½.
A. Mature larva, lateral aspect. B. Pupa, lateral aspect.
Reproduced from painting by Comm. Charles M. Dammers.

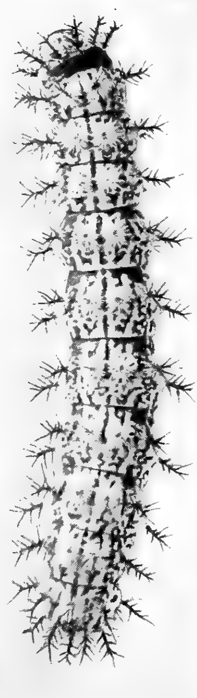


PLATE 35-A

Mature larva of *Hemileuca nevadensis californica*, dorsal view, enlarged x approx. 1¾.

Photo by Nemetz.

With an abundance of information thus available in easily accessible literature it is therefore unnecessary to repeat a description of the larva, other than to briefly recapitulate as follows:

In the mature larva the head is dark maroon, with a slight furrow on the summit. The body ground color is light yellow-buff, with occasionally a slight greenish tinge. The various spots and broken bands are black. The abdomen is dull blackish, with the spots varying from a clay green to yellow. Stigmata, oval, yellow, encircled with black. Legs, black. Prolegs and anal prolegs, reddish brown, the claspers black.

The spines are black, except for the lowermost row where the bases are black, the shafts slightly yellowish, and the tips black. The rosettes of simple spines along the dorsum are orange-yellow, with black tips.

The body is sparingly covered with short colorless hairs.

Our figures, on Plates 35 and 35-A show the larva and pupa. The latter is blackish maroon, with a few maroon hairs on the cremaster. The pupal surface is heavily rugose.

The larval foodplants are willow and poplar of various species.

Packard records two unnamed parasites recovered from this species, one being a Tachinid, the other an Apanteles.

BIBLIOGRAPHY

1. Stretch, R. H. Zyg. and Bomb. N. Am. 1, p. 108, pl. 4, fig. 10, 1872.
2. Wright, W. G. Can. Entom. 20 (2), p. 31, 1888.
3. French, G. H. Can. Entom. 26 (10), p. 293, 1894.
4. Dyar, H. G. Can. Entom. 27 (11), p. 325, 1895.
5. Packard, A. S. Memoirs Nat'l. Ac. Sci., XII, p. 191, 1914.
6. Dyar, H. G. Proc. U. S. Nat'l. Mus. 25, p. 371, 1902.
7. Edwards, Hy. Pacific Coast Lep. No. 16, p. 5, 1875.
8. Hulst, Geo. D. Entom. Amer. 3, p. 191, 1888.

Hemileuca electra W. G. Wright

This species is widely distributed in Southern California, although its late flight (November) has caused it to be taken somewhat infrequently by collectors. W. G. Wright[1] records only two specimens captured in the long period of his residence in San Bernardino, and he entirely missed the early stages in spite of the fact that, according to his own admission, Mrs. Brandegee had informed him of the foodplant (Eriogonum). Had he searched the hills in his own neighborhood during March he would have found the mature larvae in quantity. The type locality of *electra* is San Bernardino, California.

PLATE 36

Egg of *Hemileuca electra*, magnified x approx. 16.

Reproduced from painting by Comm. Charles M. Dammers.

The early stages of this handsome day-flying moth have not, to our knowledge, been recorded, although the species has been bred for many years past by lepidopterists in the San Diego and Los Angeles areas.

The eggs are laid in a mass around a twig of Eriogonum. This mass is usually irregular whereas, with *californica*, there is more frequently a definite regularity of grouping around a willow stem. Oviposition occurs in late October and November.

Egg; width, approximately 1.2 mm.; height, approx. 1.7 mm. The micropylar end is slightly depressed, and the side of the egg, when in close contact with its neighbor also shows a depression. Single eggs when not in contact with others do not show this depression on the sides. The base of the egg is rounded. Ground color, ivory-white, with a gray-green cast. The surface is heavily overlaid with a dark gray-mauve marbling, except at the micropylar end, which is white with a faint light olive marbling.

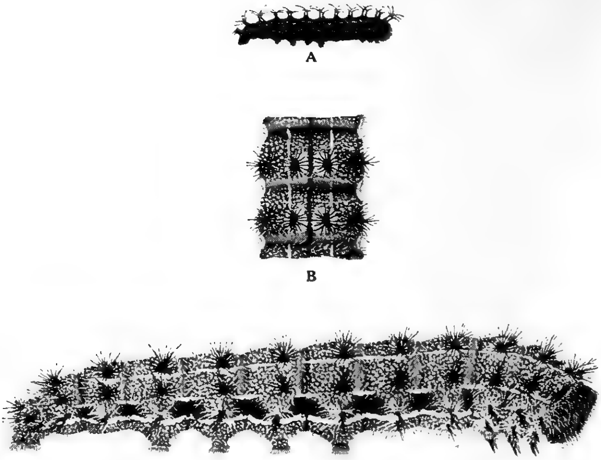
This dark marbling of the surface is absent in the egg of *H. nevadensis californica.*

The eggs hatch in January (occasionally in late December or early February) and the emerging larvae eat a round hole through the micropylar end, leaving the remainder of the shell intact.

The young larvae are gregarious, as with others of the genus. In the earlier instars they are black, with black spines and the accessory single branching spines showing yellow tips.

Mature larva, length 45 mm.

The ground color of the body is black, but this is profusely covered with round white dots, each of which has a black pupil from which arises a single short white hair. These white dots



C

PLATE 37

Larva of *Hemileuca electra.*

A. Larva, first instar, lateral aspect, enlarged approx. x 2.
B. Dorsal view of two typical segments of mature larva.
C. Mature larva, lateral aspect, enlarged x 1¾.

Reproduced from painting by Comm. Charles M. Dammers.

are absent along the segmental junctures except for a short space on the lateral surface. These segmental junctures are brick red superior to the spiracles and also as they cross the abdomen. In occasional specimens however this red is replaced with green.

There is a thin black mid-dorsal stripe, lateral to which in proximity to each spine occurs a white patch. A thin white dorso-lateral line runs longitudinally, from the head to the 11th segment, but this is discontinuous at the segmental junctures. There is also a series of longitudinal white dashes placed supra-stigmatally, each dash crossing the segmental juncture and becoming obsolescent in the center of the segment.

A wide white line follows the infrastigmatal fold (overlap).

The characteristic branching spines are all present. Those of the upper rows are a solid black, while the lower rows are black except for the yellow tips of the subsidiary branches. These lower spines have white hairs about their bases.

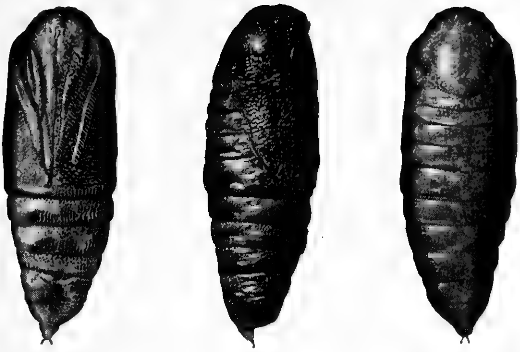
The abdomen is concolorous with the dorsal and lateral surfaces.

Spiracles, orange. Legs, black. Prolegs and anal prolegs, similar to body, the claspers pink.

Head, black, profusely covered with long white hairs.

Pupation occurs in a loosely woven cocoon formed in debris on the top of the soil.

The egg, young larva (first instar), and mature larva are illustrated on Plates 36 and 37.



A. B. C.

PLATE 38

Pupa of *Hemileuca electra*, enlarged x 1¾.

A. Ventral aspect. B. Lateral aspect. C. Dorsal aspect.

From photograph retouched by Comstock.

Pupa; length approximately 25 mm.; somewhat robust; the cephalic end well rounded, but with the labrum slightly protruded.

The surface of the pupa is rugose, and the cremaster protrudes as a heart-shaped body, crowned with two diverging hooklets. A painting of the latter, made by the junior author shows a number of recurved hooklets, but the example photographed and reproduced on Plate 38 does not disclose this feature.

The color of the chrysalis is a uniform very dark maroon.

The larvae of this species, and also of all others in the genus with which we are familiar, produce a stinging sensation when touched, which may be followed by a rash.

This species is somewhat difficult to rear successfully in the laboratory. During 1930, and again in 1931, more than a thousand larvae were secured each year, nearly all of which succumbed to wilt disease. In 1932 however, with segregation of the larvae, allowing only a few to each cage, nearly a hundred per cent were brought to pupation.

Imagos were mated in captivity on October 26, 1932. The resultant eggs hatched January 29, 1933.

Electra has been taken on the wing at Snow Creek, Azusa, Riverside and San Diego. Larvae were collected at Glendora, Riverside, Arlington, Whitewater, Chino Canyon and upper Mint Canyon, all in Southern California.

A parasite, *Anastatus semiflavidus* Gahan, was recovered from the egg.

BIBLIOGRAPHY

1. Wright, W. G. Butterflies of the West Coast, p. 257, 1906.

Hemileuca juno Packard

This species was first described by Packard in the Report of the Peabody Academy of Sciences, vol. 4, p. 87, 1872, from material collected on the border of Arizona and Sonora, Mexico. The original description was reprinted in Packard's Monograph of Bombycine Moths of North America.[1]

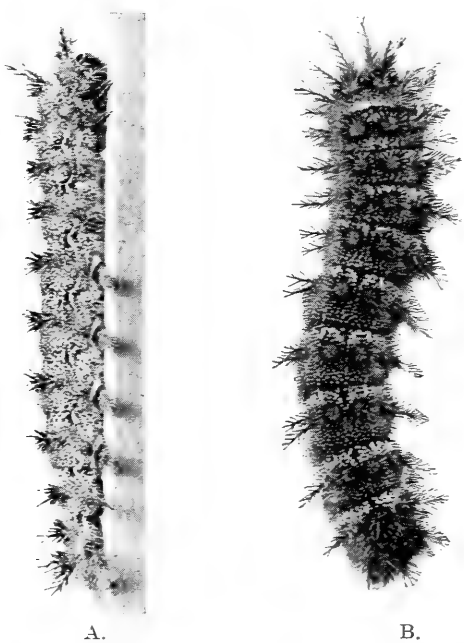
The range of the species as determined by material in the Los Angeles Museum collection is from Northern Mexico, through Arizona and New Mexico northward to Idaho, and westward to the arid regions of California.

It is probably more common than would be suggested by the relatively small numbers contained in collections.

The larva was briefly and inadequately described by Henry Edwards[2] as *H. yavapai* (a synonym of *juno*) and this was repeated in Packard's Monograph.

Townsend[3] also recorded a brief note on the larva of what he took to be this species, but in Packard's monograph it is noted that his description should refer to *H. artemis* (a synonym of *nevadensis*).

It was probably this note of Townsend's which has caused the foodplant to be listed as willow, cottonwood and poplar.



A. B.

PLATE 39

Mature larva of *Hemileuca juno*, enlarged x approx. 1⅔.

A. Lateral aspect. B. Dorsal aspect.

Photo by Cobb.

The foodplant of choice is *Prosopis* (mesquite). Whether or not it occasionally feeds on other plants remains to be proven.

Robert Andrews and Lloyd Martin secured a number of larvae of *H. juno* on May 11, 1938, near Wickenburg, Arizona, where they were feeding on *Prosopis juliflora*. These were offered *Eriogonum* and *Acacia,* both of which they refused. A young mesquite bush was finally secured from a local nursery, and the larvae readily took to it. Several examples were carried to the pupal stage, and the first imago emerged September 26, 1938.

Mature larva; length, 45 - 50 mm.

Body ground color, velvety black, thickly studded with round white spots, each one of which bears a short white hair.

The usual rows of branching spines which are characteristic of the genus occur over the body. Those on the first two segments and also on the last two caudal segments have longer central branching elements.

All of the spines are colored a rich rose-pink at their bases, and are black at the ends. In this respect the larva differs markedly from *H. electra*. This pinkish color is particularly prominent on the row which is nearest the mid-dorsal area, and gives the effect of a double row of pink rosettes transversely ranged along the dorsum.

The abdomen is a mottled gray. Legs, black. Prolegs and anal prolegs, light gray-brown. Spiracles, elongate, narrowly oval, straw colored.

Head, black, covered with short white hairs.

It will be noted that the above description records many distinctive features which will serve to separate this larva from others in the genus. It is illustrated on Plate 39.

Pupation occurs under debris on the ground.

PLATE 40
Pupa of *Hemileuca juno*, shown in dorsal, lateral and ventral aspects, enlarged x approx. 1¾.
Photo by Cobb.

Pupa; length, 24 mm. Color, dull black. The form is very robust, particularly through the anterior half, and the surface is relatively rugose, though perhaps not as markedly so as in *H. electra* and *californica*. There are apparently no setae.

The antennae terminate about 4 mm. cephalad to the edges of wings; prothoracic spiracle surrounded by a deep furrow; the remaining spiracles depressed in the center, and ringed with raised margins. They are concolorous with the body.

Cremaster, somewhat heart shaped, with a cluster of about eighteen very short recurved hooklets at the tip.

The shape, sculpture and structure of the chrysalis are adequately pictured on Plate 40.

This pupa, like many others occurring in the deserts, may hold over its emergence for several years.

A dipterous parasite, *Belvosia bifasciata* F., emerged September 26, 1938, from the chrysalis.

BIBLIOGRAPHY

1. Packard, A. S. Bombycine Moths of N. Am. Memoirs Nat'l. Acad. Sci., XII, p. 116, 1914.

2. Edwards, Henry. Entomol. Amer. 3, p. 167, 1887.

3. Townsend, C. H. T. Can. Ent. 24, p. 199, 1892.

Euthisanotia brevipennis Stretch

This species was first described by Stretch in "Zygaenidae and Bombycidae of No. America," p. 151, 1874, from a single specimen in poor condition, taken in San Francisco, California.

It is probably destined eventually to be a rare moth owing to the fact that the environment in which it breeds requires the association of *Epilobium* and *Typha* growing together in marshy ground that is not subject to floods. The rapid settlement of California, and the spoliation of our marshes is not alone playing havoc with native marsh birds, but is likewise tending toward the extermination of many insects that are dependent on this particular type of environment.

For several years past *brevipennis* has been taken in the marshy lands near Riverside, California, in quantity, and the pupae were recovered from their chambers in the *Typha* stems, but we were unable to find the larvae. Through the kindness of Mr. J. Haney of Riverside these were finally located feeding on *Epilobium californicum* Hausskn (willow herb), a member of

the Evening Primrose Family. In captivity they were reared on various species of Evening Primrose. In the north the larvae probably feed on *Epilobium franciscanum.*

The imagines are day fliers, and are on the wing between the hours (approximately) of one to three in the afternoon. The species is double brooded, one brood flying in late March, the other in late June, the progeny of which overwinter in the pupal state.

The moth may be easily mated and reared in captivity providing fresh foodplant and dry *Typha* stems are available. The captive females deposit their eggs on the sides of the breeding cage and not on the foodplant.

Egg; somewhat lenticular in form, but with the sides rounded and the top extending upward like a miniature crater; micropyle depressed. There are from forty to forty-five perpendicular ridges extending from the margin of the micropyle to the edge of the base. The depressions between these ridges are crossed by faint horizontal striations.

The color of the main body of the egg is a soiled white, with an irregular collar of magenta encircling the foot of the crater. Some examples show a magenta top. By referring to Riley's Sixth Report[1] it will be noted that the egg somewhat resembles that of *Euthisanotia grata* Fabr., but differs in having the crater-like projections on top, and having a magenta collar instead of black. The egg of *E. grata* is recorded as being "translucent yellow" rather than soiled white.

We figure the egg of *brevipennis* on Plate 41.

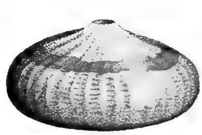


PLATE 41
Egg of *Euthisanotia brevipennis*, highly magnified.
Reproduced from painting by John A. Comstock.

Larva, first instar; length 2.5 mm.

Cylindrical, smooth, the segments well rounded. Ground color of body, whitish green. Mid-dorsally, from the 2nd to the 11th segments, there occurs on each segment a dark magenta patch, those on the caudal end being lighter.

Transversely crossing each segment on the abdominal surface, and extending superiorly to the spiracles or slightly beyond, is an irregular pale magenta band. This band is lighter on the 11th segment and extends superiorly to a juncture with the dorsal patch.

Spiracles, white, with black rims. Legs, black, with white spots. Prolegs, dark magenta, with light green claspers.

The 11th segment is stouter and higher than all others.

Each typical segment bears twelve long black setae (six on each side), arising from raised black tubercles.

Head; amber, sparingly clothed with short black hairs. Ocelli and mouth parts black. Plate 42 shows the larva in this instar, in its resting posture.

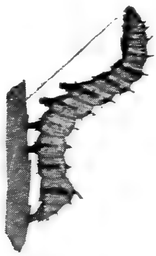


PLATE 42
Larva of *Euthisanotia brevipennis*, first instar, enlarged x approx. 12.
Reproduced from painting by Comm. Charles M. Dammers.

In the second instar there is practically no variation from the color and pattern of the first, but in the third instar the larva assumes the mature appearance.

Mature larva; length, extended, 29 mm.

Cylindrical, slightly tapering towards the head and thickening at the extremity as far caudally as the 11th segment, thence acutely sloping to the suranal plate. Body surface smooth.

The ground color is pearl-white. On each typical segment there are five transverse black bars. The space between the third and fourth bars is dark orange, except for the 2nd, 3rd and 12th segments where it is pale orange, and the first segment where the orange is entirely lacking.

There is considerable variation in the extent and character of these bands, some examples showing orange spots without black borders, others with the black so largely increased as to leave only a few orange spots.

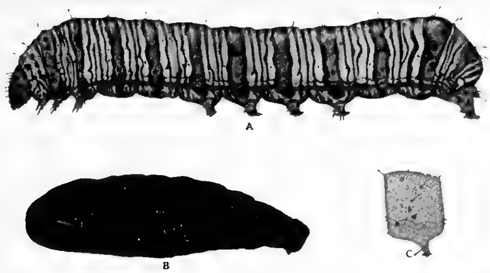


PLATE 43

Larva and pupa of *Euthisanotia brevipennis*, enlarged x approx. $2\frac{1}{4}$.

A. Mature larva, lateral aspect.

B. Pupa, lateral aspect.

C. Typical segment of larva showing position of setae.

Reproduced from painting by Comm. Charles M. Dammers.

Suranal plate, yellow with black spots. Abdomen, soiled white, with black transverse bands. Legs, soiled yellow, with two black bars across each. Prolegs and anal prolegs, soiled yellow, with large black dots, and flesh-gray claspers.

Black setae arise from round black dots on various parts of the body, their placement on the typical segment being shown on Plate 43, fig. C. There is also a minute black tubercle without an accompanying seta placed anterior to each spiracle.

Head; soiled yellow, with a number of round black spots, and a sparse covering of short black hairs. Mouth parts and ocelli, maroon. The mature larva is figured on Plate 43.

Pupation of the first brood occurs in May, and of the second in December. The larva leaves the foodplant and seeks a dead stem of *Typha* in which it excavates a burrow. The entrance is covered with a delicate glistening silk which is on a level with the surface of the stem, and somewhat difficult to detect.

Pupa; length, 19 mm.

Anterior end well rounded, the forward half cylindrical and the posterior half tapering to a blunt and nodular cremaster. The latter, in posterior view, is triangulate, the apex of the triangle pointing ventrally, and the upper two points accented by large roughened nodules. The sutures are deeply depressed at the posterior margins of the 4th, 5th and 6th abdominal segments, and these margins are smooth, allowing for free movements, in contrast to the remaining surfaces which are markedly rugose. The abdominal sutures other than those mentioned are fixed.

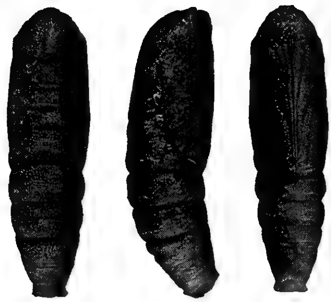


PLATE 44
Pupa of *Euthisanotia brevipennis*, shown in (A) dorsal, (B) lateral, and (C) ventral aspects, enlarged x approx. 2⅓.
Photo by Cobb.

The rugosity of the surfaces is particularly noticeable over the dorsal areas of the thorax and abdomen, where many of the nodules have sharp points. There is also a transverse row of these pointed nodules on the dorsal front margin of the cremaster, which probably serves the pupa in it movements within the chamber.

The wing surfaces have a granular texture. Spiracles conspicuous, with roughened margins.

The color is a uniform dark chestnut.

Three aspects of the pupa are shown on Plate 44.

BIBLIOGRAPHY

1. Sixth Annual Report Ins. of Mo., p. 88, 1874. C. V. Riley.

DATANA PERSPICUA MESILLAE Cockerell

Dr. T. D. A. Cockerell, in Psyche, vol. VIII, p. 41, 1897, described a subspecies of *Datana perspicua* from Mesilla, New Mexico, which he called *mesillae*. In the latest Check List of the Lepidoptera[1] McDunnough makes this a synonym of *perspicua*.

Cockerell separates his subspecies on larval differences, and on the fact that the "oblique streak to the apex of the primaries is almost or quite obsolete."

A long series of *Datana* secured in the Ibanpah Mountains, San Bernardino County, and a few specimens from the Lake

Elsinore region and from San Diego County, California, seem referable to *mesillae*. If these are the same as the New Mexican form, we note that the "oblique streak to the apex" is a variable feature, being present in about 40 per cent of our examples, and absent in the others. A noticeable difference, however, is evident in the pearly lustre of the creamy white secondaries, the apparently straighter outermost transverse line on the primaries and the almost white fringes of the secondaries.

This would suggest that *mesillae* is entitled to the status of a valid race.

We have collected numerous lots of larvae in the Ibanpah Mountains at various times, and Mr. Chris Henne in 1935 supplied us with fertile eggs from a female which he mated in captivity on July 21, and which oviposited on the following day. These hatched August 1, 1935, and the larvae were raised to maturity. The following notes were made from this brood.

Egg; chalky white, nearly spherical, the surface texture smooth but not noticeably shiny. The micropyle is a small depressed black point, as will be noted by reference to Plate 45.

The eggs are deposited in a closely packed single layer on the under side of *Rhus* leaves.

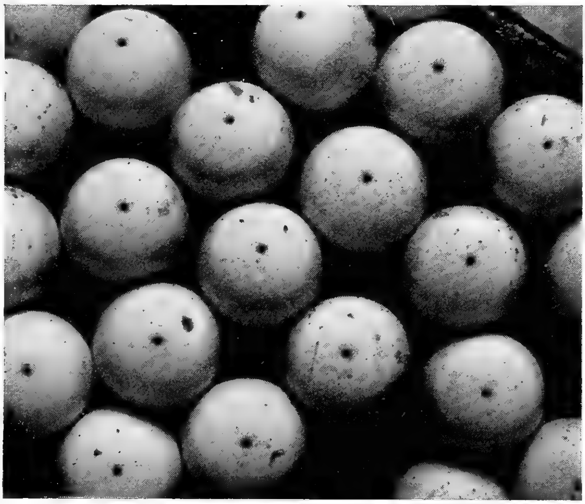


PLATE 45
A group of eggs of *Datana perspicua mesillae* viewed from the top. Highly magnified.
Photo by Cobb.

Newly emerged larva, twelve hours after hatching; length $3\frac{1}{2}$ mm.

Head, ocelli and mouth parts, jet black, very large in proportion to body, and clothed with a few short colorless hairs.

Body; ground color yellow. There is a prominent black scutellum on the dorsal portion of the first segment, with a number of black papillae studding its surface. This segment is wider than all others.

The tail bears two long black horizontal bodies which replace the anal prolegs, each of which carries a number of long hairs. Anterior to these is a horny black suranal plate bearing a number of nodules.

There are several rows of rounded black projecting papillae running longitudinally on the body, each papillus bearing from one to three long hairs. Two of these rows are placed supra-stigmatally and are formed of large, rather uniform papillae. A third row of double papillae occurs infra-stigmatally. A row of very small papillae also occurs dorso-laterally, but is absent on the first three dorsal and the last few caudal segments. The position of these various rows is accurately shown on our Plate 46.

An orange line extends laterally the length of the body. There is also a tinge of orange in the mid-dorsal area which is particularly noticeable on the 11th segment and anterior to the black caudal plate.

Legs; black. Prolegs, lighter than body, with a prominent black plate on the lateral surface of each. Claspers, black.

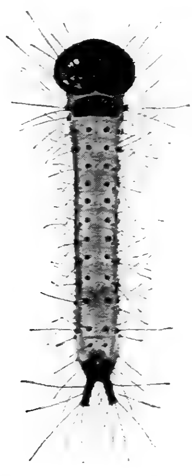


PLATE 46
Larva of *Datana perspicua mesillae*, first instar, dorsal aspect. Magnified x approx. 18.
Reproduced from painting by John A. Comstock.

As the larva approaches the termination of this instar its body becomes a deep maroon, with four longitudinal yellow lines on each side of the mid-dorsal area.

The young larvae are gregarious, and feed only on the surface tissue of the leaves. They have the peculiar habit of holding their heads and tails in a recurved position, and occasionally "bobbing" these in unison. This jerking motion was observed in our larvae only a short time after birth. Walker has noted a similar synchronous jerking in the larvae of Venessa antiopa (see Psyche, XXVI, p. 13, 1926) and Abbott[2] demonstrated that this response in *Datana* larvae was elicited by certain sounds acting on the hairs covering the body.

The first moult occurred August 7.

Second instar. Description recorded 24 hours after moult. Length, 8 mm.

Body color, deep maroon, with four bright yellow longitudinal lines on each side, the lowermost of which is sub-stigmatal in position. The black nodules at the bases of the hairs have become translucent or colorless.

Legs, jet black. Prolegs maroon, each having a black plate on the outer surface of the second joint. Claspers, black.

Spiracles, yellow centered, narrowly rimmed with black. Head and all accessory structures, jet black. In this moult the larvae feed on the entire leaf structure.

The second moult occurred August 10.

Third instar:

Larvae similar in all respects to the prior instar, except for the relatively shorter caudal processes. The moult occurred August 13 and 14.

Fourth instar; similar to last, but the ground color of the body is noticeably darker, being a deep chocolate rather than a maroon, on which the yellow lines stand out in bold contrast. The long white hairs covering the body are a conspicuous feature, and the very short secondary WHITE hairs are clearly visible. The scutellum is a dark chocolate. The two caudal processes are much shorter and more ventrally placed, though they still do not function as anal prolegs.

The two lowermost yellow lines do not affect a juncture at the caudal end as in certain other species.

Head, dark chocolate, nearly black.

Ecdysis occurred August 18 to 20.

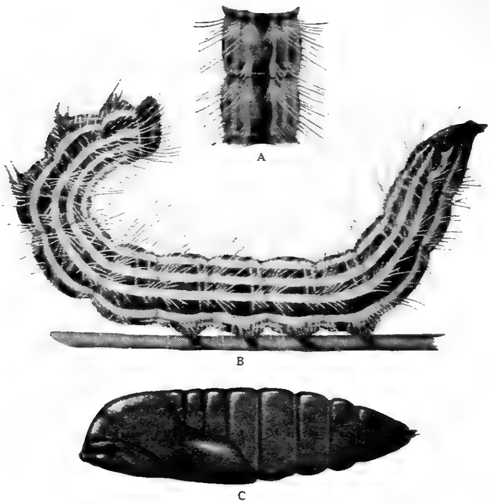


PLATE 47

Larva and pupa of *Datana perspicua mesillae*, enlarged approx. 1¾.

A. Two typical segments of mature larva, dorsal aspect.

B. Mature larva, lateral aspect.

C. Pupa, lateral aspect.

Reproduced from painting by Comm. Charles M. Dammers.

A fourth moult occurred, accounting for five instars. The brood had become so variable in size that it was difficult to record the time of casting the skins, so no record was made. There was no appreciable difference in the larva compared with the prior instar.

The first specimen pupated August 26, and the last September 2.

The junior author of this paper reared a number of different broods, and noted that two color forms occurred. One was olive-black, with black head and yellow stripes, the other maroon, with maroon head and orange stripes. The description of the Ibanpah brood given at some length herein probably represents an intermediate form.

In the black form there were two features recorded which were not noted for the dark maroon type, i.e:

On the segmental joint between the head and first segment there was a narrow carmine stripe.

At the junction of the legs with the abdomen there occurred a carmine spot topping a bulging nodule. A similar spot was present at the same site on the 4th and 5th segments and at the base of each proleg.

On all color phases the long primary hairs and also the short secondary hairs were pure white.

Pupation took place under the soil.

PLATE 48
Mature larva of *Datana perspicua mesillae*,
feeding on *Rhus*. Enlarged x 1¾.
Photo by Walter Nemetz.

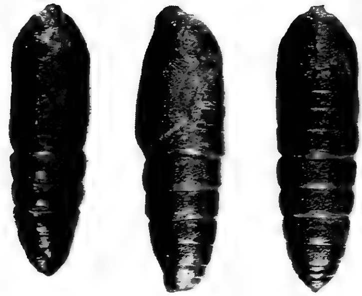
Pupa: length 26 mm.

Cylindrical, the surface finely pitted; palpi and antennae moderately prominent; a forward projection of the head and two projections of the cremaster at the caudal end, otherwise free of protuberances. The abdominal segments are gently rounded.

Color, uniform dark chestnut except for the cremaster, which is black. Three aspects of the pupa are shown on Plate 49.

The larval foodplant of choice is *Rhus trilobata* Nutt., at least in the desert areas. The species is single brooded.

Plate 48 shows the mature larva in the act of feeding. Plate



A. B. C.

PLATE 49

Pupa of *Datana perspicua mesillae* shown in (A) ventral, (B) lateral, and (C) dorsal aspect.

Enlarged x approx. 1½.

Photo by Cobb.

47 shows the dark form of the larva in characteristic resting pose, two segments of the body of a red larva, and the lateral aspect of the pupa.

Certain features in the above description would seem to differentiate this larva from that of typical *perspicua*. In order to facilitate such an analysis we briefly review several references.

In 1866 Grote and Robinson[3] quote Mr. James Angus in a brief note referring to the larva of *Datana perspicua*. Dyar pointed out, in 1890[4] that the larva of this species occurs in a red and a black form. His subsequent account of the life history in detail, published in 1891[5] makes note of the long white primary hairs and the BROWN short secondary hairs. Packard's notes on the larva, issued in 1893[6] add little to Dyar's description. He mentions the larval habit of exuding a green fluid from the mouth when touched. In the same year Dyar published in Psyche[7] an interesting table of comparisons of the larvae of twelve species of *Datana*. In 1895 Packard in his Monograph,[8] reviewed at considerable length all of the previously published information on the metamorphosis. His colored figures and line cuts of the chrysalis were a new and invaluable contribution.

BIBLIOGRAPHY

1. Check List of the Lepidoptera of Canada and the United States of America, Part 1, Macrolepidoptera. Memoirs Southern California Academy of Sciences, vol. 1, 1938.
2. Psyche, XXXIV, p. 129, 1927.
3. Proc. Ent. Soc. Phila., VI, p. 15, 1866.
4. Entom. Amer., VI, p. 131, 1890.
5. Can. Entom., XXIII, p. 82, 1891.
6. Journ. N. Y. Ent. Soc. 1, p. 61, 1893.
7. Psyche, VI, p. 573, 1893.
8. Memoirs Nat'l. Acad. Sci., VII, p. 117, pl. XIV, 1895.

A NEW APODEMIA FROM CALIFORNIA (Lepidopt.)

By John A. Comstock

In the new Check List of the Macrolepidoptera of Canada and the United States of America, Dr. J. McDunnough correctly groups the members of the genus Apodemia, with *A. mormo* Feld.[1] as the parent species (synonyms *dumeti* Behr[2] and *mormonia* Bdv.[3]), form *virgulti* Behr[4] (synonyms *sonorensis* F. & F.[5] and *cythera* Edw.[6]), form *mejicanus* Behr[7] (syn. *duryi* Edw.[8]) and form *deserti* B. & McD.[9]

Mormo is characterized by the fact that the primaries on the upper surfaces are more or less completely suffused with orange-fulvous internal to the second submarginal row of white spots, while the ground color of the secondaries is entirely gray-black.

Virgulti has much the same disposition of orange-fulvous on the primaries, but this extends somewhat beyond the second row of white spots and nearly reaches the first row. Also, in typical examples, this color is more nearly an orange-red. The secondaries have a discrete band of this orange red placed between the first and second rows of submarginal spots, the remainder of the wing being predominantly gray-black.

Mejicanus is distinguished by the great expansion of the orange-fulvous which covers practically all but the outer margins of both wings, exclusive of the white spots with their black margins.

Deserti is a desert form or race of *mormo* in which the white spots are relatively larger, the orange-fulvous of a lighter shade and the ground color more gray. Like *mormo* it has no orange-fulvous on the upper surface of primaries in the outer third of the wing, and no fulvous on secondaries, except for an occasional minute spot or two at the base.

A very distinct race occurring at Antioch, California, has recently been called to our attention by Mr. W. Harry Lange, Associate in Entomology of the University of California, for whom we take pleasure in naming it.

Apodemia mormo race langei r. nov.

Expanse, male, 18 to 24 mm. Female, 24 to 27 mm.

Male holotype, 21 mm. Fringes, checkered black and white, the black disposed at the ends of the nervules and veins. Outer third of wing (upper surface of primaries), black, with a submarginal row of seven small white spots, all of about equal size, and a second row of larger subtriangulate white spots internal

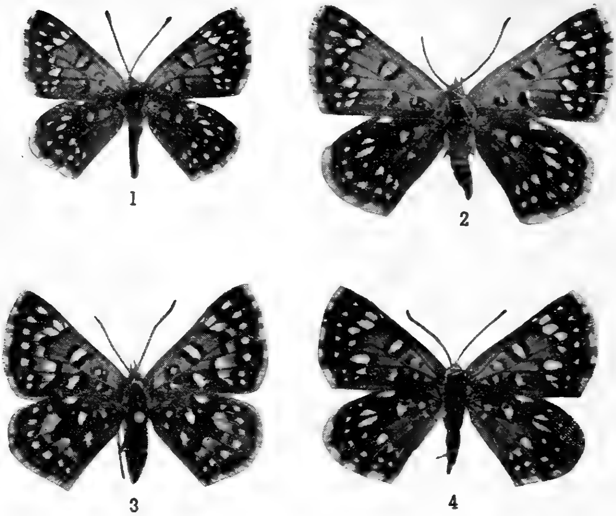


PLATE 50

Fig. 1. *Apodemia mormo langei*, holotype male.
Fig. 2. *A. mormo langei*, allotype female.
Fig. 3. *A. mormo virgulti*, female.
Fig. 4. *A. mormo*, female.
All figures enlarged x 1⅓.

Photo by Cobb.

to the first, which are of unequal size, the third and sixth being the largest. Internal to this the wing is suffused with deep orange-fulvous, except for a narrow black strip along the costal margin and a wide band of black on the inner margin.

At the outer angle of the cell there are two transverse black dashes which in all of the other species and forms previously mentioned enclose a large white spot, but which in *langei* are laved with orange-fulvous with only a minute point of white at the lower edge of the space. In the fifty examples before us there is not a single individual in which this discal spot is filled with white, but in thirty-four there are two of these small white points disposed at the opposite poles of the space, while in five examples there is no evidence of any white scaling. This feature will at once serve to separate *langei* from all other forms in our fauna, since all of the others have this space entirely filled with white.

Below this discal spot, and close to the posterior margin occur two small white points, edged internally with black, and a third white spot of similar character occurs midway between the paired spots aforementioned and the base of the wing.

Secondaries, upper surface. These are very similar to *mormo* except for one important particular. In the outer angle of the cell there occurs in all other forms under discussion a large white spot, margined with black, and a second small white spot placed midway between it and the base. In *langei* the large spot is orange-fulvous with only occasionally a small white point at the lower margin, and the innermost spot is always fulvous and is the larger of the two.

The remainder of the wing is black, with the usual two rows of white spots crossing the submarginal area. A few examples show a slight suffusion of orange-fulvous over portions of the inner half of the wing, but in the great majority this area is a solid black.

On the under surface the wings more nearly resemble those of *mormo,* although there is a heavier scaling of white, nearly approaching *deserti* in this respect. This white scaling is more heavily concentrated along the inner margin of *langei* than it is in any other of the above mentioned forms.

Antennae as in the other forms. Thorax and abdomen heavily clothed with long white scales on ventral surface as in *deserti;* dorsal surface much as in *mormo.*

Female, allotype, expanse 27 mm.; very similar to male in all respects except for the larger size. A second example shows a considerable suffusion of orange-fulvous over the inner half of second wing, but is probably atypical in this respect.

Described from 48 males and 2 females, all collected at Antioch, Contra Costa County, California, in August, 1933, and August, 1938, by W. Harry Lange; the holotype and allotype collected August 14, 1938.

Holotype, allotype and a series of paratypes in the collection of the Los Angeles Museum. Paratypes will be placed with the National Museum in Washington, the Canadian National Museum at Ottawa, the Philadelphia Academy of Natural Sciences, the California Academy of Sciences, San Francisco, and the British Museum. A series will be returned to Mr. Lange.

It is possible that *Apodemia mormo langei* may prove to be restricted to a very narrow territory in the San Joaquin Valley. Concerning its locus Mr. Lange writes: "this species is confined to a narrow strip of sand dunes running east from Antioch along the San Joaquin River. I have never seen it very common and have found it associated with a rather tall *Eriogonum*, 1-3 feet high, with tall flower stalks and a rosette of leaves at the base." Undoubtedly this *Eriogonum* is the larval food plant.

The author has reared *A. deserti* from *Eriogonum inflatum* which is a somewhat similar plant.

It may be noted in connection with this genus that Seitz[10] has erred in several particulars. He states that *mejicanus* Behr occurs in North California, whereas Dr. Behr gives the type locality as "from the Sierra Madre, in the neighborhood of Mazatlan." (Mexico.)

It does not occur in California.

Seitz also misspells *duryi* (as *druryi*) and incorrectly credits it to Henry Edwards. His figure of *cythera* does not match the illustration of the type as shown in Holland's Butterfly Book.[11]

REFERENCES

1. Wien. ent. Mon., iii, 271, 1859.
2. Proc. Calif. Acad. Sci., iii, 178, 1865.
3. Lepid. de la Calif., 52, 1869.
4. Proc. Calif. Acad. Sci., iii, 178, 1865.
5. Reise Nov. Lep., ii, 303, 1865.
6. Trans. Am. Entom. Soc., Iv, 345, 1873.
7. Proc. Calif. Acad. Sci., iii, 179, 1865.
8. Papilio, ii, 47, 1882.
9. Cont. to the Lepid., Iv (2), 75, 1918.
10. Macrolep. of the World, vol. 5, p. 700.
11. The Butterfly Book, revised ed., plate XXVIII, figs. 5, 6.

AN ANNOTATED LIST OF THE LEPIDOPTERA OF SANTA CATALINA ISLAND, CALIFORNIA

Part II. SPHINGIDAE AND ARCTIIDAE

By Don Meadows
Long Beach, California

Since the appearance of the first part of this paper (Bull. So. Calif. Acad. Sci., XXXV, December, 1936) Dr. J. McDunnough's Check List of the Lepidoptera of Canada and the United States has been published and the nomenclature of that list is used in preference to the Barnes and McDunnough list as originally planned.

Fourteen species and one new form are included in the present paper. The list will be continued in a future paper.

The absence or rarity of many moths on Catalina Island is difficult to explain. The strong winged White-lined Sphinx, *Celerio lineata,* so common on the mainland, is rare on the island. *Platysamia euryalus* and other Saturnid moths which could easily be blown or carried to Catalina are missing even though the larval food plant is common. Neither of the Syntomid species, *Ctenucha brunnea* or *C. multifaria* are found though their food plant and ecological conditions are present. Both of the species are abundant on the shores of the mainland only eighteen miles away. Perhaps parasitism or adverse weather conditions have brought about the extermination of many species that have become established on the island. Such causes are much more apt to bring about extermination of species in an area as restricted in size as Catalina than on continental land masses where species are more widely distributed.

Unless the new form herein described proves to be so, none of the species listed in this paper are endemics.

A map of Santa Catalina Island, showing the general topographic features and the principal collecting localities accompanies this paper.

Family SPHINGIDAE

33. Phlegethontius sexta Joh.

The most common Sphingid on Catalina Island. Taken every month in the year except December. Most abundant during spring and fall months. Larvae feed on several species of *Solanaceae* though they seem to prefer the island endemic, *Solanum wallacei* and the coyote tobacco, *Nicotiana glauca.*

The tremendous holding power of the prolegs of the larvae was demonstrated by recording the pull necessary to dislodge a specimen from a branch of giant nightshade. A full grown larva was placed on the underside of a stem, a spring balance attached to a small cup was hooked between the second and third pairs of prolegs, and water was poured into the cup until the weight was sufficient to pull free the larva. Four hundred and eleven grams (14.6 oz.) were necessary to dislodge the larva.

34. Phlegethontius quinquemaculata Haw.

Only one specimen taken, a female, Avalon, XI-2-1932.

35. Sphinx perelegans Hy. Edw.

Fairly common around Avalon during April and May. An occasional specimen was taken in October.

36. Smerinthus cerisyi ophthalmicus Bdv.

Common during March and April at Avalon and Middle Ranch. The pale form *saliceti* was never taken.

37. Celerio lineata Fabr.

Rare on Catalina Island. Only a few records from Avalon in March, and one, a female, from Middle Ranch, IV-4-1933.

Family ARCTIIDAE

38. Crambidia lithosioides Dyar

Taken in large numbers in light trap at Avalon in April, May, June, September, October and November. Food plant probably the filamentous lichen common on the scrub oak as the imagoes were frequently found in association with trees heavily infested with the so-called "oak moss."

39. Cisthene conjuncta B. & McD.

Frequent captures in light trap at Avalon during September and October.

40. Cisthene faustinula Bdv.

Fairly common with *C. conjuncta.*

41. Cisthene dorsimacula Dyar

One record, light trap, Avalon, IX-26-1932.

42. Hemihyalea edwardsii Pack.

Common in light trap and around store windows in Avalon during September and October. Slow on the wing and easy to

capture. A grating sound, caused by friction between the primary and secondary wings, was frequently noticed when specimens were captured by hand.

43. Hemihyalea edwardsii form ochreous form nov.

Like *H. edwardsii* in size and maculation, but with all red or reddish shades replaced by ochreous yellow or very pale orange. Abdomen dorsally ochreous yellow, slightly more yellow than thorax. (Abdomen bright orange red in *edwardsii*). Abdominal tuft yellow brown. Inner angle of secondaries yellow. Upper surface of primaries noticeably yellow in allotype. Antennae light brown (rusty brown in *edwardsii*). Upper surface of femur of forelegs very pale orange yellow (salmon red in *edwardsii*).

Two examples: Holotype and allotype.

Type locality: Avalon, Santa Catalina Island, California.

Holotype male, Avalon, October 1, 1929. Allotype, female, Avalon, April 14, 1934. Holotype in Los Angeles Museum; allotype in author's collection.

44. Apantesis proxima autholea Bdv.

The most common Arctiid on the island. Specimens collected throughout the year. Most abundant in fall and spring, but never in great numbers at any one time. Food plants: all types of succulent grasses. Larvae sometimes of economic importance in gardens and on the golf course, but imagoes held in check by a high percent of parasitism, particularly the hymenopterous species *Ophion*.

45. Apantesis nevadensis geneura Stkr.

During the second week in April, 1928, I spent five days collecting in the vicinity of Emerald Bay at the north end of Catalina Island. Camp was established under a large eucalyptus tree some twenty yards from the water's edge. Every evening, about an hour before sunset, hundreds of thousands of black wooly Arctiid larvae would appear on the grass, shrubs and trees growing around the bay. A small percent of the caterpillars were feeding; the rest were aimlessly crawling about. All varieties of plant life were eaten by the larvae but the heaviest consumption of food was in a patch of wild clover some two acres in extent. At night the haphazard migration of larvae rustled the grass around camp like a gentle shower of rain. At daybreak the great movement of larvae had stopped, though their widespread activities were noticeable everywhere. Windrows of drowned specimens were along the beach where the larvae had been caught by the tides. Rocks, dead trees, bushes, cactus,

and even our camp gear was heavily infested. Caterpillars were found near the top of the eucalyptus tree, sixty feet from the ground. Every morning both sea and land birds appeared in numbers and feasted, especially along the water's edge. By nine o'clock each day the larvae were not so evident but thousands could be found by looking under the dense grass that covered the surrounding hills.

More than a thousand larvae were collected and taken back to Avalon. Practically all pupated within a few days, but less than 1 per cent emerged as imagoes. Two parasites were responsible, an ichneumonid fly, *Ophion*, and to a lesser extent, a tachinid fly. The pupal period extended over five months. Imagoes began to appear on August 15 and continued to emerge until October 2, 1928. The greatest number came out September 20. All were *Apantesis nevadensis geneura* Stkr.

During the rest of my stay on Catalina, until June, 1934, not a single specimen of *geneura* was seen, though the Emerald Bay country was visited many times. In 1929 the *Ophion* flies were extremely abundant on the island.

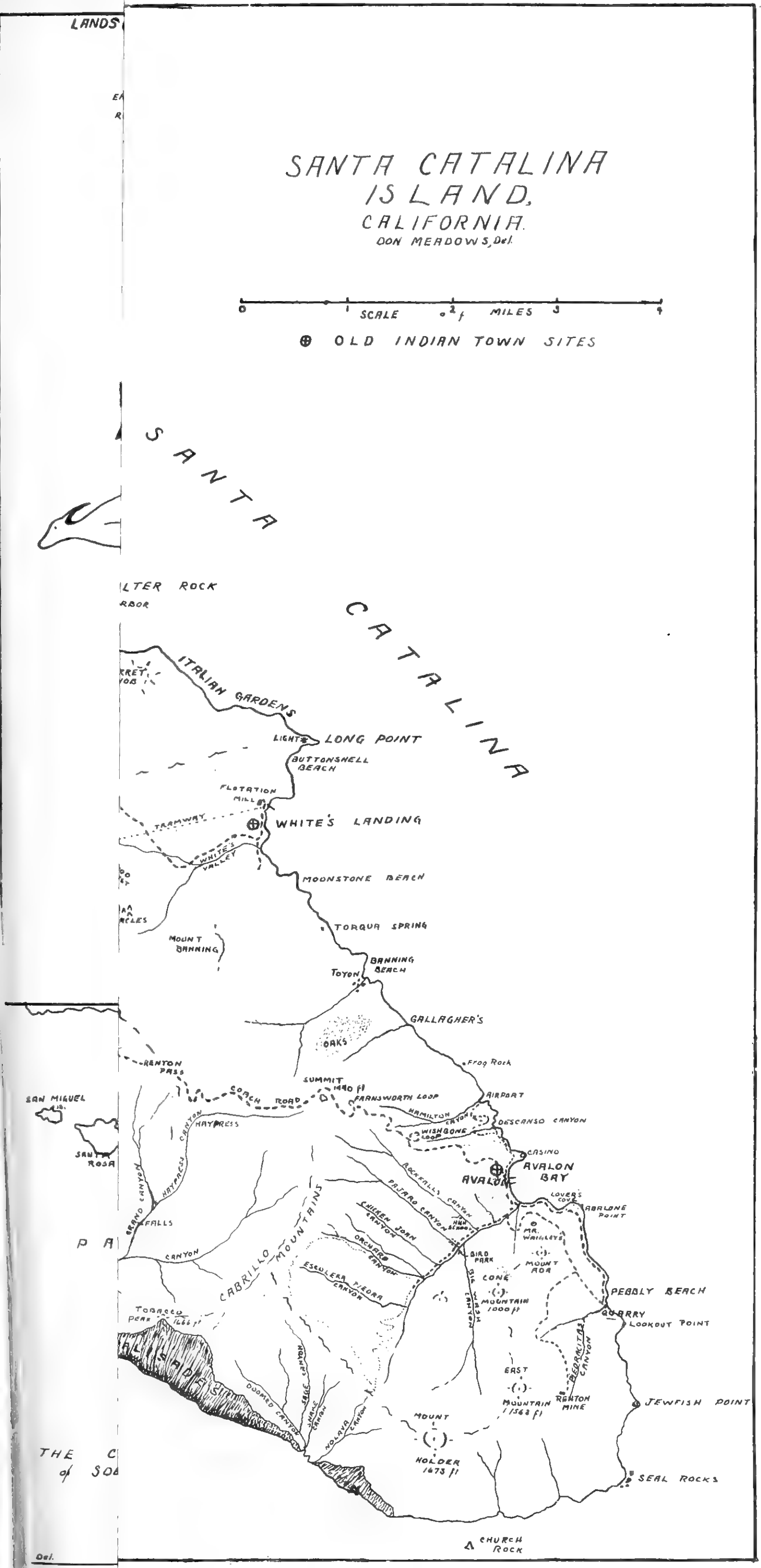
On June 21, 1938, Dr. T. D. A. Cockerell collected several *Arctiid* larvae at Wilson's Cove on San Clemente Island. They had pupated when they came into my possession, and on September 21, one imago, a female, emerged. It belonged to this same race.

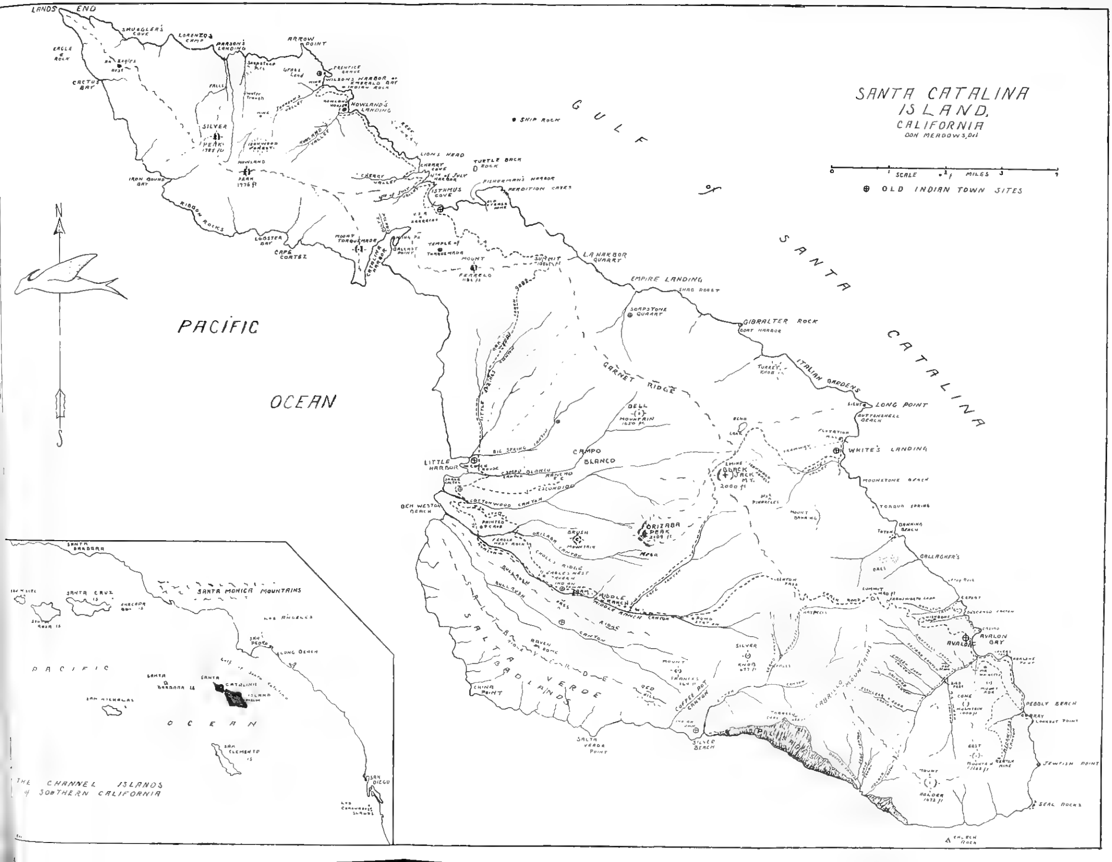
46. Estigmene acrea Dru.

Only one specimen, a male, Avalon, March 6, 1930.

47. Arachnis picta Pack.

Abundant in light trap and around lights in Avalon during September, October and November. Occasional at Middle Ranch. Food plant, lupine.


SANTA CATALINA
ISLAND,
CALIFORNIA.
DON MEADOWS, Del.
0 1 SCALE 2 MILES 3 4
⊕ OLD INDIAN TOWN SITES
SANTA CATALINA
ITALIAN GARDENS
LIGHT
LONG POINT
BUTTONSHELL BEACH
FLOTATION MILL
TRAMWAY
WHITE'S LANDING
WHITE'S VALLEY
MOONSTONE BEACH
TORQUA SPRING
MOUNT BANNING
BANNING BEACH
Toyon
GALLAGHER'S
OAKS
Frog Rock
RENTON PASS
SUMMIT 1480 ft
COACH ROAD
FARNSWORTH LOOP
AIRPORT
HAMILTON CANYON
DESCANSO CANYON
WISHBONE LOOP
HAYPRESS
HAYPRESS CANYON
CASINO
AVALON
AVALON BAY
LOVER'S COVE
ABALONE POINT
GRAND CANYON
FALLS
CANYON
CABRILLO MOUNTAINS
ROCKFALLS CANYON
PAJARO CANYON
CHICKEN JOHN CANYON
ORCHARD CANYON
ESCULERA PIEDRA CANYON
MT. WRIGLEY'S
BIRD PARK
MOUNT ADA
CONE MOUNTAIN 1000 ft
PEBBLY BEACH
QUARRY
LOOKOUT POINT
TOBACCO PEAK 1666 ft
PALISADES
DOOMED CANYON
SAGE CANYON
SNAKE CANYON
MOJAVE CANYON
EAST MOUNTAIN 1562 ft
RENTON MINE
JEWFISH POINT
MOUNT HOLDER 1673 ft
SEAL ROCKS
CHURCH ROCK
LANDS
SAN MIGUEL
SANTA ROSA
THE
of SO
Del.


SANTA CATALINA ISLAND, CALIFORNIA
DON MEADOWS, Del
SCALE MILES
OLD INDIAN TOWN SITES
GULF of SANTA CATALINA
PACIFIC OCEAN
LANDS END
SMUGGLER'S COVE
LORENZO'S CAMP
PARSON'S LANDING
ARROW POINT
EAGLE ROCK
CACTUS BAY
SILVER PEAK 1785 ft
HOWLAND'S LANDING
SHIP ROCK
LIONS HEAD
TURTLE BACK ROCK
IRON BOUND BAY
ISTHMUS COVE
PERDITION CAVES
RIBBON ROCKS
LOBSTER BAY
CAPE CORTEZ
CATALINA HARBOR
MOUNT FERRELO
L.A. HARBOR QUARRY
EMPIRE LANDING
SOAPSTONE QUARRY
GIBRALTER ROCK
ITALIAN GARDENS
GARNET RIDGE
DELL MOUNTAIN 1650 ft
LONG POINT
WHITE'S LANDING
LITTLE HARBOR
CAMPO BLANCO
BLACK JACK MT. 2000 ft
COTTONWOOD CANYON
BEN WESTON BEACH
ORIZABA PEAK 2109 ft
GALLAGHER'S
MIDDLE RANCH
MIDDLE RANCH CANYON
AVALON BAY
AVALON
PEBBLY BEACH
JEWFISH POINT
SEAL ROCKS
CHINA POINT
SALTA VERDE POINT
SILVER BEACH
COFFEE POT CANYON
SILVER KNOB
CABRILLO MOUNTAINS
SALT BADLANDS
SALTA VERDE
THE CHANNEL ISLANDS of SOUTHERN CALIFORNIA
SANTA BARBARA
SANTA CRUZ IS
SANTA MONICA MOUNTAINS
LOS ANGELES
SAN PEDRO
LONG BEACH
SANTA BARBARA IS
SANTA CATALINA ISLAND
SAN NICHOLAS
SAN CLEMENTE IS
PACIFIC OCEAN
SAN DIEGO

TWO NEW CALIFORNIA ACMAEODERA (Coleoptera—Buprestidae)

By Mont A. Cazier
University of California

Acmaeodera adenostomae Cazier, New Species

Small, narrow, convex; shining black above, cupreous beneath.

Female: Head shallowly punctate, punctures separated by about one-sixth of their own widths on vertex, confluent anteriorly, vertex with narrow shallow impression, front rather densely clothed with long brown hair; clypeus with anterior margin rather deeply emarginate, separated from front by prominent impression; antennae extending beyond base of pronotum, segments two and three equal, four slightly longer than two, five wider than four, six wider than five and subequal to succeeding segments. Pronotum as wide as base of elytra, one-third wider than long, apical margin emarginate, base truncate, sides nearly straight, obtusely tapering anteriorly; discal punctures separated by about their own widths, confluent laterally, oblique lateral impression shallow, ending in a prominent fovea; surface immaculate, rather densely clothed with long brown hair. Elytra convex, sides straight to apical third, then obtusely rounded to apex, side margins serrate; striae well marked on disc, shallow impression at base, humeral umbone prominent, surface moderately clothed with long brown hair; three straw-yellow fascia interrupted at middle, humeral fascia broken into large median spot and small marginal spot, middle fascia not reaching suture, slightly oblique basally, apical fascia transverse, interrupted before suture, marginal half red, inner half straw-yellow, two subapical spots situated medially. Beneath sparsely punctate, punctures separated by twice their own widths, thoracic sternites moderately clothed with long white hair, abdomen sparsely clothed; prosternum sinuate, prominent on either side of middle; last ventral segment with rather prominent pointed sub-marginal carina. Length 7.5 mm., width 2.5 mm.

Male: Same as female except for its smaller size.

Holotype female and allotype male in the author's collection, collected at Sunset Valley, Santa Barbara County, California, July 14, 1938 by the author on *Adenostoma fasciculatum*. Specimens from additional California localities are as follows: Sunset Valley, Santa Barbara County, July 4, 1937 and July 4, 1938 (B. E. White, V. L. Woolley); Pasadena, Los Angeles

County, June 10-12, 1916 (J. O. Martin), May 22, 1925, May 22-25, 1924 (E. C. Van Dyke), June 18, 1924; Hastings Natural History Reservation, Jamesburg, Monterey County, June 14, 1938 (C. D. Michener); San Jacinto Mountains, Riverside County, July 29, 1912 (J. C. Bridwell); Mt. Wilson, Los Angeles County (E. C. Van Dyke); Paraiso Springs, Monterey County, May 30, 1916 (L. S. Slevin); Gilroy Hot Springs, San Mateo County, July 4, 1928 (J. O. Martin); Pinnacles National Park, San Benito County, April 29, 1914 (L. S. Slevin); Keen Camp, Riverside County, June 6-12, 1917 (E. P. Van Duzee).

Described from a series of 107 specimens which are deposited as follows: B. E. White 27, J. J. duBois 7, L. V. Woolley 6, Frances Simes Hastings Natural History Reservation 2, San Francisco Academy of Science 38, Los Angeles Museum 4, and 23 in the author's collection. The series shows variation in the coloration of the undersurface which is cupreous-black in a few specimens, the subapical spot is occasionally half red and sometimes has a small red spot on the margin opposite it, the length varies from 6 mm. to 8:3 mm.

This species has been in many collections for years but has always been associated with *A. jocosa,* which has the markings heavier but of the same pattern, and by some has been considered as being either a seasonal form or the male of that species. During the course of a revisional study of the genus the author extracted the male and female genitalia of both of these species, along with others, and found that the female genitalia of *adenostomae* were entirely different from that of *jocosa.* The male genitalia are identical in the two as is also the case between other distinct species. Further elaboration of these genitalia studies along with illustrations will be given in a revision of the genus to be published at a later date.

Although *adenostomae* closely resembles *jocosa* in markings it is only distantly related when the form, sculpturing and female genitalia are considered. This is also true in relation to *coquilletti* Fall and *purshiae* Fisher, both of which are more closely related to *jocosa.* However, *adenostomae* does closely resemble *angelica* Fall and *angelica nexa* Fall in its general shape, sculpturing and female genitalia, differing in its heavier markings and by having the sides of the pronotum obtusely rounded and widest at middle.

Acmaeodera robusta duboisi Cazier, New Subspecies

Robust, moderately depressed; elytra bluish-black with cupreous tinges, pronotum brilliant cupreous, beneath brilliant cupreous throughout.

Female: Head with punctures on vertex separated by about their own widths, confluent anteriorly, vertex with moderately prominent carinae, rather densely clothed with long white hair; clypeus with anterior margin shallowly emarginate; antennae extending backward to about basal third of prothorax, second segment shorter and more robust than third, third and fourth equal, fifth abruptly widened and equal to succeeding segments. Pronotum as wide as base of elytra, twice as wide as long, apical margin emarginate, base truncate, sides evenly obtusely rounded, widest at base, margins visible from above only at apical half; disc with median impression, punctures separated by twice their widths, becoming confluent laterally, oblique lateral impression ending in a moderately deep fovea; color brilliant cupreous, sides with pale yellow spots extending from base to apical third; surface clothed with moderately dense brown hair. Elytra with sides subparallel to apical third, then obliquely tapering to tip, side margins serrate; disc depressed, punctures arranged in indistinct striae, separated by their own widths, apical and lateral striae distinct with punctures confluent, interspaces with small punctures each of which contains a moderately long brown hair, humeral umbone prominent; color bluish-black with occasional cupreous tinges, three straw colored broken fasciae and apical spot arranged as follows; basal fasciae oblique from margin around umbone almost to base, middle and apical fasciae transverse, apical spot extending along margin almost to apical fasciae. Beneath brilliant cupreous throughout, moderately clothed with long white pile; prosternum sinuate, sparsely punctate; abdomen with only slight indication of subapical carinae, sparsely punctate. Length 9 mm., width 3.5 mm.

Male: Same as the female except for the color of the undersurface which is brilliant cupreous-purple. Length 8 mm., width 3 mm.

Holotype female and allotype male in the author's collection, collected at Furnace Creek, Death Valley, California, April 14, 1938, on *Prosopis juliflora glandulosa* by J. J. duBois after whom the author takes pleasure in naming the subspecies. Four hundred and twenty-six designated paratypes collected at the same locality by J. J. duBois, B. E. White and V. L. Woolley and deposited in their collections as well as in the collections of the California Academy of Sciences, Los Angeles Museum and the author.

This subspecies is closely related to *A. robusta* Horn and *A. robusta rubrosuffusa* Fall but is easily distinguishable from either by its straw yellow markings. In addition to this character it can be further separated from *robusta* by the color of the prothorax and undersurface which are cupreous and cupreous-purple rather than bluish-black as in *robusta*. From *robusta*

rubrosuffusa it can be distinguished by the complete lack of the red suffusion on the disc of the elytra. The markings, sculpturing, male and female genitalia show no reliable differences. *A. robusta* and subsp. *rubrosuffusa* occur on flowers of various compositae and other plants throughout Owens Valley, California, and southern Nevada and Utah, whereas *duboisi* occurs on *Prosopis* on the floor of Death Valley, California and has thus far never been collected or found associated with *robusta* or *rubrosuffusa.* The series of *duboisi* used show no indication of gradation into either *robusta* or *rubrosuffusa.*

There is a good deal of variation in several characters and the known limits of these variations are given in what is to follow; the carina on the head is occasionally very prominent and extends a short distance down the front, an occasional specimen has a small straw-yellow spot midway between the eyes on the front, the markings vary from specimens having the fasciae withdrawn from the suture and reduced, to those having the fasciae connected longitudinally and with accessory spots between them, length 7 mm. to 12 mm.

The author would like to express his thanks and appreciation to those previously cited as having contributed specimens and information pertaining to the new species herein described, to Dr. C. W. Leng whose fine collection of this genus serves as a basis for this study, to Dr. E. C. Van Dyke for loans of material from his extensive collection and to Mr. E. P. Van Duzee of the California Academy of Sciences for material loaned from the collections in his charge.

ALASKAN FISHES CAUGHT IN SHRIMP TRAWLS

By Lore R. David and Howard R. Hill

In the course of a field trip to southern Alaska during the summer of 1936, Mr. George Willett of the Los Angeles Museum secured a collection of fishes in the vicinity of Petersburg. Through the courtesy of Mr. Earl N. Ohmer, superintendent of a shrimp cannery at Petersburg, Mr. Willett was permitted to accompany the shrimp fishermen on their boats during fishing operations. All fishes and marine invertebrates, usually thrown overboard after each haul, were saved and preserved in alcohol.

The shrimp hauls were made in the period between June 14 and August 21, off Le Conte glacier near Petersburg, in water from 15 to 60 fathoms in depth, with the majority of hauls in 30 fathoms. Fishing usually commenced about 6 a. m. and lasted until noon or shortly afterward. The following list adds to our knowledge of the distribution of Alaskan fishes.

Rajidae

Raja aleutica Gilbert

Two specimens 260 mm. in length.

The median spines differ in number from the numbers given by Evermann and Goldsborough for the species. One specimen shows 5 similar spines before the pectoral girdle and after a short interspace 32 additional spines. None are between the two dorsals. Besides the median spines, two distinct spines are present on the pectoral girdle. The other specimen has 3 large and 2 indistinct spines on the median line before the pectoral girdle followed, after a short interspace, by 31 spines and one between the dorsals. Four other spines are present on the pectoral girdle. Evidently the number and form of the median spines are quite variable.

Chimaeridae

Hydrolagus colliei (Lay & Bennett)

Two specimens, 160 mm., 950 mm.

The tail of the smaller specimen has a long filament while the tail of the larger specimen is broken away. Evermann and Goldsborough also recorded an Alaskan specimen with a long tail filament. We doubt whether the presence or absence of a filament is a sufficient character to distinguish the Atlantic from the Pacific species.

Osmeridae

Osmerus dentex Steindachner.

Twenty-three specimens 75 to 135 mm. long.

Gadidae

Boreogadus saida (Lepechin)

Thirteen specimens 90 to 170 mm. long.

Pleuronectidae

Atheresthes stomias (Jordan & Gilbert)

One specimen 180 mm. long.

Hippoglossoides elassodon (Jordan & Gilbert)

Two specimens 165 mm. to 185 mm. long.

Lepidopsetta bilineata (Ayres)

Three specimens 63 to 145 mm. long.

The dorsal rays are 73 to 75 and the anal rays 57 to 58 in number. The coloration is grayish, mottled with black spots; with a series of dark spots on the dorsal and anal.

Glyptocephalus zachirus (Lockington)

Thirteen specimens 135 to 190 mm. long.

Trichodontidae

Trichodon trichodon (Tilesius)

Eleven specimens 95 to 170 mm. long.

Cottidae

Icelus spiniger Gilbert

Three specimens 102 to 135 mm. long.

Triglops beani Gilbert

Two specimens, 115 mm. and 150 mm. long.

Prionistius macellus Bean

One specimen 200 mm. long.

Elanura forficata Gilbert

One specimen 110 mm. long.

Histiocottus bilobus (Cuv. & Val.)

Two specimens, each 135 mm. long.

Myoxocephalus polyacanthocephalus (Pallas)

Two specimens, each 165 mm. long.

Leptocottus armatus Girard

One specimen 230 mm. long.

Dasycottus setiger Bean

Four specimens 40 to 175 mm. long.

Gilbertidia sigalutes (Jordan & Starks)

Fifty-three specimens 30 to 85 mm. long.

Rhamphocottidae

Ulca bolini Myers

Twenty-five specimens 50 to 195 mm. long.

Agonidae

Podothecus acipenserinus (Tilesius)

Eighteen specimens 110 to 250 mm. long.

Bathyagonus nigripinnis Gilbert

Fourteen specimens 165 to 195 mm. long.

Cyclopteridae

Eumicrotremus orbis (Günther)

Eighteen specimens 15 to 33 mm. long.

Aptocyclus ventricosus (Pallas)

One specimen 125 mm. long. The Alaskan specimen seems considerably broader and deeper than those coming from Japan.

Elephantichthys copeianus Hubbs

One specimen 140 mm. long.

Liparididae

Liparis mucosus Ayres

Two specimens, each 80 mm. long.

Liparis dennyi Jordan & Starks

Two specimens 150 mm. and 270 mm. long.

D. 44 to 45, A. 34 to 35, P. 38 to 40.

Liparis cyclostigma Gilbert

Three specimens 154 to 225 mm. long.

D. 41 to 43, A. 33 to 36, P. 40.

In his revision of the Liparididae, Burke (1930) distinguishes three closely related species: *Liparis dennyi, L. cyclostigma* and *L. gibbus*. According to him these occur in neighboring but not overlapping regions. Two of this group are present in the Petersburg material and we have attributed them to the species *L. dennyi* and *L. cyclostigma* as indicated above. The number of fin rays as well as size of the eye agree well with the specific diagnosis of each species. In *L. cyclostigma* the head is broad and very depressed while in *L. dennyi* the head is decidedly higher and smaller. (See measurements in table I.) In alcoholic specimens, the color of the flesh in *L. dennyi* is pinkish, the thin skin darkly marbled and the fins darkly margined. In *L. cyclostigma*, the coloration is dusky in some specimens and entirely black in others. *L. cyclostigma* proves to be distributed much farther south and occurs in the same region as *L. dennyi*.

TABLE I—COMPARATIVE MEASUREMENTS OF *L. CYCLOSTIGMA* AND *L. DENNYI*
(Dimensions in mm.)

Species:	*L. dennyi*	*L. dennyi*	*L. cycl.*	*L. cycl.*	*L. cycl.*
Total length	150	270	154	230	255
Length of head	39	71	42	62	66
Depth of head	28½	53	27½	44	49
Breadth of head	33	59	41	54	58
Diameter of eye	8	9	7½	7½	9

Careproctus rastrinus Gilbert & Burke.

Eleven specimens 97 to 175 mm. long.

D. 42, A. 36, P. 39.

Bathymasteridae

Bathymaster signatus Cope

Eight specimens 130 to 300 mm. long.

Ronquilus jordani (Gilbert)

Four specimens 135 to 160 mm. long.

Pholididae

Pholis ornatus (Girard)

Six specimens 75 to 210 mm. long.

Stichaeidae

Bryostemma decoratus Jordan & Snyder

Five specimens 120 to 190 mm. long. The pectorals in all specimens are nearly as long as the head.

Anoplarchus p. purpurescens Gill

Six specimens 70 to 170 mm. long.

Poroclinus rothrocki Bean

Eleven specimens 150 to 255 mm. long.

Leptoclinus maculatus (Fries)

Two specimens, each 170 mm. long.

Lumpenus anguillaris (Pallas)

Eight specimens 230 to 290 mm. long.

Lumpenella longirostris (Everm. & Goldsbr.)

Sixteen specimens 150 to 230 mm. long.

Zoarcidae

Lycodalepis polaris (Sabine)

Nine specimens 130 to 320 mm. long.

Bothrocara mollis Bean

Twenty specimens, 130 to 150 mm. long.

Gobiesocidae

Caularchus mœandricus (Girard)

Six specimens 60 to 75 mm. long. This species, collected by Mr. Willett near Ketchikan, has not heretofore been reported from Alaskan waters.

HISTORICAL SKETCH OF THE ACADEMY

THE Southern California Academy of Sciences had its genesis in a prior organization known as the Southern California Science Association, which was organized November 6, 1891, and functioned actively until May of 1896. Barely a dozen members made up this founding group. Its first President was Dr. M. H. Alter. Mrs. Mary H. Hart served as its first Secretary, and Prof. William Lundberg as first Treasurer.

This organization held numerous lectures on scientific subjects during its nearly five years of existence. The list of speakers numbered many who were noteworthy contributors to the upbuilding of science and the development of history in the Southwest during this period, as may be noted from the following partial list:

Dr. Anstruther Davidson, Prof. D. W. Coquillett, Mr. B. W. Griffith, Mr. C. N. Wilson, Mr. William A. Spalding, Prof. William Lundberg, Mrs. M. Burton Williamson, Mr. William H. Knight, Prof. A. J. McClatchie, Capt. Thomas B. Merry, Major Powell, Judge Samuel Minor.

Its active membership roll in 1895 numbered ninety-four names.

Only one publication was issued by the Southern California Science Association. This was a short paper on "Tidal Evolution" by B. R. Baumgardt, which is now a very rare item.

In 1896 the name of the organization was changed officially to the Southern California Academy of Sciences and its elected officers for that year were: President, William H. Knight; Secretary, B. R. Baumgardt; Treasurer, George H. Bonebrake.

Forty-seven years have passed since that first meeting of the founders, and the list of men who have guided the affairs of the organization is one worthy of permanent recording.

SOUTHERN CALIFORNIA SCIENCE ASSOCIATION

PRESIDENTS

1891-1892—Dr. H. M. Alter
1892-1893—Dr. Anstruther Davidson
1893-1895—William H. Knight
1895-1896—Abbott Kinney

SECRETARIES

1891-1892—Mrs. Mary H. Hart
1892-1893—William H. Knight
1893-1896—B. R. Baumgardt

TREASURERS

1891-1895—Prof. Wm. Lundberg
1895-1896—George Roughton

SOUTHERN CALIFORNIA ACADEMY OF SCIENCES

PRESIDENTS

1896-1897—William H. Knight
1897-1898—William A. Spalding
1898-1900—Abbott Kinney
1900-1902—Wm. H. Knight
1902-1904—Dr. Theodore B. Comstock
1904-1905—Prof. Melville Dozier
1905-1909—B. R. Baumgardt
1909-1913—William A. Spalding
1913-1918—Arthur B. Benton
1918-1919—Dr. Hector Alliot
1919-1920—H. O. Collins
1920-1923—Dr. F. C. Clark
1923-1925—Dr. Mars Baumgardt
1925-1926—William A. Bryan
1926-1927—John A. Comstock
1927-1928—Samuel J. Keese
1928-1929—George W. Parsons
1929-1931—Dr. Ford A. Carpenter
1931-1932—Theodore Payne
1932-1936—Harry K. Sargent
1936-1938—Dr. Howard R. Hill

SECRETARIES

1896-1905—B. R. Baumgardt
1905-1906—Prof. Melville Dozier
1906-1907—Melville Dozier and H. O. Collins
1907-1913—Holdredge O. Collins
1913-1914—Robert LeRoy Beardsley
1914-1919—H. O. Collins
1919-1921—George W. Parsons
1921-1926—Dr. John A. Comstock
1926-1931—Dr. R. H. Swift
1931-1934—Howard R. Hill
1934-1938—Dr. Carl S. Knopf

TREASURERS

1896-1897—George H. Bonebrake
1897-1898—Dr. E. A. Praeger
1898-1900—Wm. H. Knight
1900-1901—W. C. Patterson and Anstruther Davidson
1901-1903—Dr. Anstruther Davidson
1903-1906—G. Major Tabor
1906-1928—S. J. Keese
1928-1931—Wm. A. Spalding
1931-1936—Harry K. Sargent
1936-1938—Dr. J. A. Comstock

From the beginning the Academy launched a program of publication, in association with its popular lecture courses, which has borne noteworthy results. Its first circulars and reports were issued in cooperation with the Agricultural Experiment Section. Concurrently with these a more ambitious series of *Proceedings* was issued, beginning in July, 1896 and extending to September, 1899. As all of these publications are, and have for many years been out of print, and many of them were noteworthy contributions, a list of titles and authors is here recorded for the first time in detail:

1. First annual Report of the Director, November, 1897. Agricultural Experiment Section. S. M. Woodbridge.
2. Circular No. 1. "Milk Supply of Los Angeles." Nov. 15, 1897. A. J. McClatchie.
3. "Remedies for Cut Worms." May, 1897. S. M. Woodbridge.
4. "Cleaning Citrus Trees of Insect Pests." Aug., 1897. S. M. Woodbridge.
5. "Milk; Composition, Nature, Hygiene and Economic Methods of Handling." (20 pages.) August, 1897. A. J. McClatchie.
6. "Cleaning Walnuts and Other Nuts." (10 pages.) September, 1897. S. M. Woodbridge.
7. "Status of Soil Analysis." (10 pages.) September, 1897. M. L. Wade.
8. "Relative Economic Value of Bone Meal." November, 1897. S. M. Woodbridge and E. M. Wade.
9. Circular No. 2, "Sorghum." March, 1898. S. M. Woodbridge.
10. "Inter-Irrigation." No date, 1900-1901. S. M. Woodbridge.
11. "Navel Lemon." No date, 1900-1901. Anonymous.
12. "Oiled Roads." (14 pages.) No date. Theo. F. White and S. M. Woodbridge.
13. "Protect the Shade Trees—How!" No date. S. M. Woodbridge.

PROCEEDINGS

1. Vol. 1, No. 1. "Catalog of the Plants of Los Angeles County." July, 1896. (35 pages.) Anstruther Davidson.
2. Vol. 1, No. 2. "Eucalyptus." Abbott Kinney. September, 1896. (298 pages.)
3. Vol. 1, No. 3. "California Bees and their Parasites." A. Davidson. April, 1897. (12 pages.)
4. Vol. 1, No. 4. "Lichens of Southern California." Hasse. 1897. (20 pages.)
5. Vol. 1, No. 5. "Seedless Plants of Southern California." A. J. McClatchie. July, 1897.
6. Vol. 1, No. 6. "Antiseptic Vegetation for Cuba." A. Campbell Johnson. September, 1899.

The virility of the Academy in this formative period was due primarily to a small group of able men who served it faithfully and generously. Not all of these can be mentioned in this brief recital, but a few must not be passed by, since without their contribution the Academy would long since have ceased to function.

Bernard R. Baumgardt served from 1893 to 1896 as the Secretary of the Southern California Science Association, and thereafter for nine consecutive years in the same capacity, with the Academy. He held the Presidency of the Academy from 1906 until 1909. As Secretary he worked with great success in expanding the membership. Many of the early publications were printed in his shop, and some of these were from type which he personally had set up. His keen interest in Astronomy, History and Literature, and a native ability to project his enthusiasm to others soon drew a large following into the Academy. His lectures, given freely for Academy

members, soon attracted outside notice, and from this there finally developed a remarkable career as a public speaker and lecturer, which called him frequently to foreign shores, and won for him a place as an international figure.

ABBOTT KINNEY, the founder of Venice, California, served one term as President of the Southern California Science Association, and two terms in the same office with the Academy. His publication of the volume on "Eucalyptus" as Number 2 of Volume 1 of the *Proceedings* in 1896 was an outstanding contribution to botany.

WILLIAM H. KNIGHT, first President of the Academy, was a pioneer of wide intellectual attainments, as his several papers in early issues of the *Bulletin* attest. He was founder, and for many years President of the Los Angeles Astronomical Society. As an early member of the California Academy of Sciences in San Francisco he had the honor of naming Lake Tahoe, and it was he who suggested to James Lick the bequest which founded the Lick Observatory. A tribute to him was published in the *Bulletin* of May, 1925, page 54 (Volume 24.) The first article in Volume 1, Number 1 of the *Bulletin* was from his pen.

DR. ANSTRUTHER DAVIDSON, second President of the Southern California Science Association, and Treasurer of the Academy in 1901-1902, has left an undying name in the annals of southwestern botany. His discovery of many new species of plants, published in various issues of the *Bulletin*, and his book on the Botany of Southern California are a part of the literature that is essential to students in this field. His herbarium was left to the Academy, and is now housed in the Los Angeles Museum. His earlier publications on Hymenoptera and their parasites are also classics in the field of entomology. He was one of the pioneer physicians of Los Angeles, and his labors for the Academy in its struggling period have earned for him a place of honor in the Society's records.

JOHN DAGGETT HOOKER was the first Vice-president of the Academy. Mr. Hooker achieved an independent fortune in mercantile lines, in the early period of Los Angeles, and he devoted his means unstintingly to the cause of science and philanthropy. His gifts were made anonymously, in keeping with the modest character of this great citizen. During the formative period of the Academy its several activities usually overshot the limits of its restricted budget, and Mr. Hooker generously made up the deficits.

His greatest contribution to science was the presentation to the Mt. Wilson Observatory (Carnegie Institution) of the hundred inch reflecting telescope. Not so well known is the fact that our own Academy officers, and particularly B. R. Baumgardt, encouraged and gave moral support to that gift, in full realization of the great importance to science and the advancement of knowledge that would accrue therefrom. Several tributes to John D. Hooker have been published in our *Bulletin.*

GEORGE WHITWELL PARSONS, one of the original founders of the Academy, a Director for many years, and President in 1909, was a pioneer geologist of wide reputation. His work, as Chairman of the Mining Division of the Los Angeles Chamber of Commerce, in establishing the desert sign posts in the arid waste lands of the southwest, won him national repute, and was the means of saving many lives. A brief sketch of his life occurs in the January issue of Volume 32, page 38 of our *Bulletin.*

DR. HECTOR ALLIOT was President of the Academy in 1918-1919. He was a gentleman of great personal charm and wide intellectual attainments. A tribute to him was published in 1919 by the Academy, and given wide distribution.

He was, for many years, Director of the Southwest Museum. As an educator, lecturer, writer and cultural leader he made a profound impression upon this community, and he left a record of accomplishment that will endure. Our Director, William A. Spalding, expressed the feeling of all who knew Dr. Alliot when he said, "he was the most versatile man and the most

thorough in his various fields of activity," and also "he was one of the truest, most gracious and most lovable of friends."

ARTHUR BURNETT BENTON served as President of the Academy from 1913 to 1918. A brief biography of his life and work was published in the September, 1927 issue of the *Bulletin.*

Mr. Benton made an enviable record as an architect and engineer in Southern California. One of his outstanding achievements was the Mission Inn at Riverside. His work on the restoration of the missions was only one of many activities that have helped to enshrine his name in the hearts of Californians.

PROF. MELVILLE DOZIER was one of the pioneer educators of Los Angeles. He was the second Secretary of the Academy, in 1905 and 1906, and served as its President in 1904 and 1905.

An account of his many activities and accomplishments was published in the *Bulletin* for September, 1936.

DR. FORD A. CARPENTER is a representative of the Academy on the present Board of Governors of the Los Angeles Museum. He served as President of the Academy from 1929 to 1931.

Dr. Carpenter's place in the field of Meteorology and Aeronautics is too well established to need further comment here. As a member of our Board of Trustees he has been, and still is a dynamic force in the governmental affairs of the organization. His many articles contributed through the past several years to our *Bulletin* are classics in their field.

THEODORE PAYNE, for many years a member of the Academy Board of Trustees, and who served as President in 1931-1932, has endeared himself to thousands of amateur and professional horticulturists throughout the world. His work in popularizing the use of native California wild flowers and plants has been an outstanding contribution. As a member of our official family he has at all times given unstintingly of his time and knowledge in the furtherance of the welfare of the Academy.

WILLIAM A. SPALDING is the only member of the pioneer group of founders now remaining. His many interests and accomplishments are so ably set forth in Dr. Rockwell D. Hunt's "California and Californians," volume 4, pages 156-158, that they will not be repeated here. Needless to say, Mr. Spalding's own "History of Los Angeles City and County," a three volume work published in 1931 does not carry these references, but that work will carry his name to posterity.

BULLETIN

In 1902 there appeared the first issue of the *Bulletin of the Southern California Academy of Sciences.* It came from the press of B. R. Baumgardt, and issued for the first year as a monthly publication. The editor was also B. R. Baumgardt, an office without portfolio, which he held skillfully for several years. This journal has appeared regularly since that date with one or more numbers each year. It is now (1938) in its thirty-seventh volume. It has earned for itself, and the Academy, an enviable reputation, and its influence on scientific thought has continued to expand with the years. The *Bulletin* now reaches most of the important libraries, museums and scientific societies throughout the world. Its earlier volumes, long out of print, are eagerly sought by learned institutions, to complete their files.

The contributors to this publication number some of the best known specialists in the several fields of science, as may be gleaned from this partial tabulation:

GEOLOGY AND PALEONTOLOGY

Dr. Lorenzo G. Yates
Prof. James Z. Gilbert
Prof. J. J. Rivers
Dr. John C. Merriam
William L. Watts
Dr. David Starr Jordan
Harold Hannibal
G. Dallas Hanna
Eric Knight Jordan
Carlton M. Carson
Leo G. Hertlein
Dr. Chester Stock
Dr. Hildegarde Howard
U. S. Grant
A. M. Strong

ENTOMOLOGY

Prof. Jas. J. Rivers
Dr. Theodore D. A. Cockerell
Fordyce Grinnell, Jr.
Dr. Anstruther Davidson
Foster H. Benjamin
Roy E. Campbell
Dr. J. McDunnough
Harold Compere
Dr. William Barnes
Alonzo Davis
Dr. August Busck
Dr. John A. Comstock

CONCHOLOGY

Harold Hannibal
George Willett
Ida S. Oldroyd

ORNITHOLOGY

Donald R. Dickey
A. J. Van Rossem

BOTANY

S. B. Parish
Dr. Anstruther Davidson
Dr. LeRoy Abrams
Dr. H. E. Hasse
A. A. Heller
Abbott Kinney
Prof. Willis L. Jepson
George L. Moxley
Charles F. Saunders
Ivan M. Johnston
Dr. Philip A. Munz
F. Raymond Fosberg
Ralph Hoffman

ARCHEOLOGY

Dr. F. M. Palmer
Dr. Hector Alliot
Arthur Woodward
Dr. Roy L. Moodie
Dr. Carl S. Knopf

ASTRONOMY

William H. Knight
Holdridge Ozro Collins
William A. Spalding
Bernard R. Baumgardt
Dr. Walter S. Adams

MARINE BIOLOGY

Prof. James Z. Gilbert
Prof. Albert B. Ulrey
Dr. Howard R. Hill

METEOROLOGY

Dr. Ford Ashman Carpenter

MEMOIRS

This year (1938) has witnessed the beginning of an additional publication by the Academy in the launching of Volume I of its *Memoirs*. The first volume contained a "Check List of the Macrolepidoptera of Canada and the United States of America" by Dr. J. McDunnough, Chief of the Division of Systematic Entomology, Department of Agriculture of the Canadian Government. Dr. McDunnough is considered by most entomologists to be the foremost authority in his line on the American Continent. The "Check List" has filled a long felt want, and has been most favorably received. It continues to be in great demand, and will be a vitally important work for many years to come.

The purpose of the *Memoirs* is to give an outlet for important technical works in the biological sciences which are too large for inclusion in the *Bulletin*.

LECTURES

In addition to its series of publications, the Academy has furthered the cause of science by a series of public lectures, which have been carried on throughout practically its entire span of existence.

The purpose of these has been to present the findings and conclusions of science and scientists to the laity in popular form. No admission charge has ever been made by the Academy for these lectures, notwithstanding the fact that many speakers of national and even international reputation have graced our programs.

At the present time the lectures are presented at the regular monthly dinner meetings of the Academy, which are held in the Chamber of Commerce banquet rooms on the second Tuesday evening of each month.

The Academy has never had an official Editor for its publications, but this rather exacting post has been filled by various members of the Board of Trustees as a voluntary and anonymous service. Although no names are recorded either in the minutes, or journals, of those who performed this unrequited service, fortunately some of the living members have recalled their names.

For many years B. R. Baumgardt filled this post. One has only to review the *Bulletins* issued prior to

909 in order to realize in what iasterful manner he performed this ask. Thereafter, for many years Ioldredge Orzo Collins carried on hese arduous duties. His scholarly ttainments and methodical turn of iind ably fitted him for the post. nvaluable records of the progress nd activities of the Academy were ut into print with meticulous accuacy by both of these pioneers. Were : not for these labors it would ow be impossible to follow the hread of historic accomplishment hrough the early period. All of the fficial record books of the Academy rior to 1907 are lost, and we of his generation have B. R. Baumardt and H. O. Collins to thank for heir preservation in the pages of ur *Bulletin*.

From August, 1921, to date (Deember, 1938) the *Bulletin* has been dited by John A. Comstock.

INCORPORATION

Some time prior to 1907 discusions had occurred in the meetings f the Academy bearing on the adisability of taking out incorporaion papers. It was realized by iembers of the Board of Trustees hat in order to hold properties and ndowments, and administer them or the benefit of the public, free of axation, such action was imperaive. This finally resulted in articles f incorporation being issued on Iay 11, 1907.

SECTIONS

In its first year of operation the cademy initiated the policy of esablishing sections for the various pecialists in order that every memer might find a special division i which he or she might actively articipate. Much of the early work f the organization was accomplishd through these sections, and many f the papers published in the *Bul-etin* had their origin therein. At arious times one or another of hese sections was exceedingly ctive.

Although some of these still exist hey are, at the present writing, in state of hibernation. Perhaps hey are awaiting another Davidson i Botany, or Theodore Comstock in eology, or Alliot in Anthropology, r leaders of similar caliber and orce, to bring them back into acive functioning.

RANCHO LA BREA

In the early part of the summer of 1908, Prof. James Z. Gilbert, a Fellow of the Academy, began excavating skeletal remains from the asphaltum pits of Rancho la Brea. In the meeting of the Biological Section of the Academy of June 12, 1909, he exhibited the fossil remains of several extinct animals, and outlined plans for the participation of the Academy in these exhumations. In cooperation with the Board of Trustees he had been instrumental in obtaining, in June of 1908, from Mrs. Erskine M. Ross, owner of the Rancho, a permit for the Academy to carry on these excavations. Financial backing was secured from the Los Angeles City Council, the Board of Supervisors and the ever generous John D. Hooker. By January of 1910 the work was well under way.

In the January, 1910, issue of the *Bulletin* Prof. Gilbert published a historic paper, outlining at considerable length the nature of these deposits and the work accomplished up to that time.

THE LOS ANGELES MUSEUM

Concurrently with the above activity a movement had been launched to build a museum in what was then known as Agricultural Park. The Board of Trustees of the Academy, early in 1910, entered into negotiations with the Board of Supervisors of Los Angeles County, the Historical Society of Southern California, the Fine Arts League (now defunct) and the Southern Division of the Cooper Ornithological Club, as an outgrowth of which a contract was drawn up providing for the organization, support and governing of a museum devoted to history, science and art. This instrument was signed on February 7, 1910. Thus came into being the Los Angeles Museum of History, Science and Art. The corner stone of the first unit of the Museum was laid on December 17, 1910, with impressive ceremonies, and the name of the park was officially changed to Exposition Park. In the recess of that corner stone was placed a number of documents, including a history of the Southern California Academy of Sciences, written by William H. Knight.

The fame of the Rancho la Brea collections has spread throughout the world, and the contributions made to science by the Los Angeles Museum are widely known, but few persons realize the outstanding part played by the Academy in this development.

One of the important stimulants to research lies in the recognition accorded by scientific societies to those who contribute to its cause, either by means of financial assistance or contributions to knowledge. In keeping with this policy the Academy has, from time to time, granted certain honors and distinctions. These have taken the form of honorary designations such as "Patrons," "Fellows," "Honorary Members," "Life Members," etc.

No complete list of honors in these several classes has been published up to this time. A careful search of the records and proceedings reveals the following:

PATRONS

Bancroft E. Beeman
Myra Hershey
John Daggett Hooker
Elizabeth Hornung, in memory of her husband, Dr. John Hornung
Wilhelm Schrader
John S. Vosburg

HONORARY MEMBERS

Mrs. Mary A. Beeman
S. E. Coleman
Prof. P. Giovanni Hagen
Dr. George E. Hale
G. Allan Hancock
J. Von Hepperger
Dr. J. H. Maiden
Prof. A. J. McClatchie
J. J. Montgomery
S. B. Parish
Dr. Lewis Swift
Prof. Dr. Edmund Weiss
Dr. Lorenzo C. Yates

LIFE MEMBERS

William H. Avery
R. M. Bennett
A. M. Benton
Dr. H. M. Bishop
David R. Brearley
Dr. Norman Bridge
Dr. R. L. Burchman
A. M. Chaffey
W. A. Cheney
Dr. Frank C. Clark
Dr. Theodore B. Comstock
James Cuzner
Dr. Anstruther Davidson
Myra Hershey
John D. Hooker
Samuel J. Keese
James B. Lankershim
Homer Laughlin, Jr.
Mrs. Mary P. Moll
Dr. E. O. Palmer
S. B. Parish
W. C. Patterson
Theodore Payne
Frank X. Pfaffinger
Mrs. Erskine M. Ross
Mrs. George S. Safford
Wilhelm Schrader
William A. Spalding
C. E. Toberman
John S. Vosburg
William L. Watts

FELLOWS

Prof. Paul Arnold
Dr. C. A. Bailey
Bernard R. Baumgardt
Dr. Mars F. Baumgardt
George H. Beeman
Robert LeRoy Beardsley
Arthur B. Benton
Dr. Herbert M. Bishop
G. A. Bobrick
Charles B. Boothe
Gail Borden
Prof. F. P. Brackett
Dr. Norman Bridge
William A. Bryan
Dr. F. D. Bullard
W. A. Butterworth
Dr. Jessie A. Cady
C. J. Callahan
William J. Canfield
Dr. Ford Ashman Carpenter
J. H. Chamberlain
H. D. Cheney
Hon. W. A. Cheney
Dr. Edith J. Claypool
Holdredge Ozro Collins
Dr. Theodore B. Comstock
Dr. John A. Comstock
Dr. Anstruther Davidson
Dr. W. J. Davis
Prof. Melville Dozier
Dr. Charles Lincoln Edwards
Dr. Alfred Fellows
Charles R. Fletcher
Prof. James A. Foshay
Prof. James Z. Gilbert
O. H. Goodwin
Dr. John R. Haynes
W. A. Hendryx
Dr. Howard R. Hill
A. S. Hoyt
Dr. West Hughes
John D. Hooker

Dr. J. C. Hunt
Irving E. Ingraham
Dr. J. H. Johnson
Samuel J. Keese
Abbott Kinney
William H. Knight
Dr. Carl S. Knopf
Prof. E. L. Larkin
Dr. J. M. Lee
Alvin H. Low
Malcolm Macleod
Dr. A. L. McLeish
Dr. F. C. E. Mattison
Prof. E. S. McClelland
Dr. J. D. Moody
Mrs. R. O. Moody
Dr. J. C. Nevin
George W. Parsons
W. C. Patterson
Theodore Payne
Dr. Carl H. Phinney
Mrs. T. A. Randall
Paran F. Rice
Dr. James R. Rogers
Harry K. Sargent
William A. Spalding
Dr. R. H. Swift
G. Major Tabor
Dr. Dain L. Tasker
Prof. A. B. Ulrey
Dr. L. G. Vischer
John S. Vosburg
E. M. Wade
Dr. Guy W. Wadsworth
William L. Watts
Dr. Clement A. Whiting
Dr. S. M. Woodbridge
Dr. John Woodbridge

ENDOWMENTS AND MEMBERSHIPS

The financial sinews of the Academy are derived principally from its endowments, memberships, sale of and subscriptions to its publications and special gifts. The organizing and accounting for the funds derived from these sources rests principally with the Treasurer. Much of the substantial foundation on which is built the present security of the Academy's financial standing is due to the long years of faithful service of Samuel J. Keese.

Mr. Keese was an electrical engineer by profession, and a business executive of rare ability. A brief biography occurs in Volume 27, Part 1, page 55 of the *Bulletin*. He served the Academy as Treasurer continuously for twenty-two years, from 1906 to 1928, and his wise counsel was of tremendous aid to his fellow Trustees in guiding the affairs of the organization.

The Academy does not make a practice of indiscriminately soliciting new members. The responsibility of recruiting these rests on the shoulders of such of its own members as are active and in good standing. Each new candidate must be sponsored by a member, and must be a person who is interested in some phase of scientific advancement. It is not required however that this interest be technical or specialized.

Since the Academy maintains several classes of memberships, these are here noted for the guidance of those members who may wish to interest others in the work of the Society.

LOCAL MEMBERSHIP

This entitles the holder to notices of all meetings and lectures, but does not carry the right to vote at the annual meeting or to receive Academy publications. Dues for this class of membership are $3.00 per year.

ANNUAL MEMBERSHIP

This carries all privileges including voting rights, publications, notices of Academy activities, and enrollment in the list of full membership for the period of time in which the dues of $5.00 per annum are paid.

LIFE MEMBERSHIP

This is granted only to such persons as have given the sum of one hundred dollars to the Endowment Fund of the Academy. It carries all privileges for the period of the donor's life.

PATRON

This distinction is voted only to those persons who donate or bequeath to the Academy, for its Endowment Fund, the sum of one thousand dollars or more.

The two other classes of membership, i.e. "Fellows" and "Honorary Members" are wholly honorary in character and are voted by the Board of Trustees of the Academy to individuals who have performed outstanding service to science or who have made valuable contributions of an altruistic nature to organizations engaged in furthering intellectual advancement.

J. A. C.

BULLETIN of the SOUTHERN CALIFORNIA
ACADEMY of SCIENCES

Published by the Academy at Los Angeles, California
Subscription—$2.00 per year

Free to Life Members and Unlimited Annual Members
of the Academy (Annual Membership Fee $5.00)

Address all communications to DR. JOHN A. COMSTOCK

Care of Los Angeles Museum, Exposition Park,

Los Angeles, Calif., U. S. A.

PUBLICATIONS OF THE SOUTHERN CALIFORNIA ACADEMY OF SCIENCES

The Academy has published to date the following:

PROCEEDINGS, 1896 to 1899. Six numbers—Vol. 1, Nos. 1 to 6.

MISCELLANEOUS BULLETINS issued under the imprint of the Agricultural Experiment Station, 1897 to 1907. *Ten numbers.*

All issues of the above are now out of print.

● ●

Bulletin of the Southern California Academy of Sciences

Began issue with Vol. 1, No. 1, January, 1902. Issued ten numbers in 1902; nine numbers in 1903, 1904, 1905; three numbers in 1906. Issued two numbers annually from 1907 to 1919, both inclusive (except 1908—one issue only). Issued four numbers (January, May, July and October) in 1920.

The 1921 issues are: Vol. XX, No. 1, April; Vol. XX, No. 2, August; Vol. XX, No. 3, December.

The 1922 issues are: Vol. XXI, No. 1, March; Vol. XXI, No. 2, September.

The 1923 issues are: Vol. XXII, No. 1, March; No. 2, July.

The 1924 issues are: Vol. XXIII, No. 1, January-February; No. 2, March-April; No. 3, May-June; No. 4, July-August; No. 5, September-October; No. 6, November-December.

From 1925 to 1938, including volumes XXIV to XXXVII, three numbers were published each year. These were issued as No. 1, January-April; No. 2, May-August; No. 3, September-December, for each volume.

PUBLICATIONS OF THE SOUTHERN CALIFORNIA ACADEMY OF SCIENCES

For Sale at the Appended Prices

BULLETIN:

	To Members	To Non-Members
Complete set, Vols. 1 to 33, bound		$100.00
(Incomplete set) Vols. 8 to 33, bound		80.00
Vol. 3, No. 7, 1904	$ .25	.50
" 4, " 5, 1905	.25	.50
" 6, " 1, 1907 (Photostat only)	2.00	4.00
" 6, " 2, 1907	.25	.50
" 7, " 1, 1908	1.00	2.00
" 8, " 1, 1909	1.00	2.00
" 9, " 1, 1910	2.00	4.00
" 9, " 2, 1910	.75	1.50
" 10, " 1, 1911	1.00	2.00
" 10, " 2, 1911	2.00	4.00
" 11, " 2, 1912	1.00	2.00
" 12, " 1, 1913	1.00	2.00
" 15, " 2, 1916	.75	1.50
" 16, " 2, 1917	1.00	2.00
" 17, " 1, 1918	2.00	4.00
" 17, " 2, 1918	1.50	3.00
" 18, " 2, 1919	2.00	4.00
" 19, " 1, 1920	.50	1.00
" 19, " 4, 1920	.50	1.00
" 20, " 1, 1921	2.00	4.00
" 20, " 2, 1921	2.00	4.00
" 20, " 3, 1921	2.00	4.00
" 21, " 1, 1922	2.00	4.00
" 21, " 2, 1922	1.00	2.00
" 22, " 1, 1923	1.50	3.00
" 22, " 2, 1923	2.00	4.00
" 23, " 1, 2, 3, 4, 5, 6, 1924 (each)	.25	.50
" 24, " 1, 2, 3, 1925 (each)	.25	.50
" 25, " 1, 1926	2.00	4.00
" 25, " 2, 3, 1926 (each)	.25	.50
" 26, " 1, 2, 3, 1927 (each)	.25	.50
" 27, " 1, 2, 3, 1928 (each)	.25	.50
" 28, " 1, 2, 3, 1929 (each)	.25	.50
" 29, " 1, 2, 3, 1930 (each)	.25	.50
" 30, " 1, 2, 3, 1931 (each)	.25	.50
" 31, " 1, 2, 3, 1932 (each)	.25	.50
" 32, " 1, 2, 3, 1933 (each)	.25	.50
" 33, " 1, 2, 3, 1934 (each)	.25	.50
" 34, " 1, 2, 3, 1935 (each)	.25	.50
" 35, " 1, 2, 3, 1936 (each)	.25	.50
" 36, " 1, 2, 3, 1937 (each)	.25	.50
" 37, " 1, 2, 3, 1938 (each)	.25	.50

MEMOIRS:

Vol. 1, No. 1, 1938—paper cover	2.00	4.00
" " " " " bound in black fabrikoid	3.00	5.00
" " " " " printed on one side of page	3.00	5.00
" " " " " printed on one side of page (bound)	4.00	6.00

(*Continued on next page*)

Miscellaneous, Publications of Affiliated or Co-operating Organizations

Lorquinia—Vols. 1, 2 (all published)...bound $1.50, unbound $1.00

Southern California Geology and Los Angeles Earthquakes, R. T. Hill .... bound 5.00

Southwest Science Bulletin, May 5, 1920 (all published), chiefly Entomological, 1 colored plate 1.00

Check-list of the Recent Bivalve Molluscs (of N. W. Coast of Am. from the Polar Sea to San Diego), W. H. Dall 1.00

Reprints:

Check-list of the Lepidoptera of Boreal America. Superfamilies Sphingoidea, Saturnioidea and Bombycoidea (printed on one side of page only, to allow of additional notes), Wm. Barnes and Foster H. Benjamin, 1927 ....$ .50

The Cacti of the Pyramid Peak Region, Dona Ana County, New Mexico, 1931. F. R. Fosberg .... .25

Check-list of the Macrolepidoptera of Canada and the United States of America by Dr. J. McDunnough, 1938, printed on white bristol board, one side of page (without index) suitable for labels. To Academy members, $1.50. To non-members 3.00

ADDRESS ALL INQUIRIES TO
SOUTHERN CALIFORNIA ACADEMY OF SCIENCES
(Care DR. JOHN A. COMSTOCK)
Los Angeles Museum, Exposition Park,
Los Angeles, California, U. S. A.

Bulletin, Southern California Academy of Sciences

Vol. XXXVII, 1938

INDEX OF SUBJECTS

New species and varieties indicated in **bold face type.**

INDEX OF AUTHORS

REPRINTS: Contributors of articles accepted for publication in the *Bulletin* should order reprints, if desired, when they return galley proof to the Editor. They may be ordered through the Editor at the following rates, from the McBride Printing Co., 415 East Eleventh Street, Los Angeles, Calif., the contributor paying for all his reprints.

PRICE LIST OF REPRINTS

(WITHOUT COVERS)

	4pp.	8pp.	12pp.	16pp.	20pp.	24pp.	28pp.	32pp.
50 copies	$3.75	$ 5.75	$ 8.50	$10.25	$11.75	$13.50	$16.00	$17.00
100 "	4.50	7.50	10.75	12.75	15.00	17.25	20.25	21.50
150 "	5.25	9.25	13.00	15.25	18.25	21.00	24.50	26.00
200 "	6.00	11.00	15.25	17.75	21.50	24.75	28.75	30.50
250 "	6.75	12.75	17.50	20.25	24.75	28.50	33.00	35.00
300 "	7.50	14.50	19.75	22.75	28.00	32.25	37.25	39.50

Covers: 50 for $2.00—additional covers 1½c each.

California State 3% Sales Tax to be added if delivered within the state.